JUNE, 1928

# Railway Engineering and Maintenance

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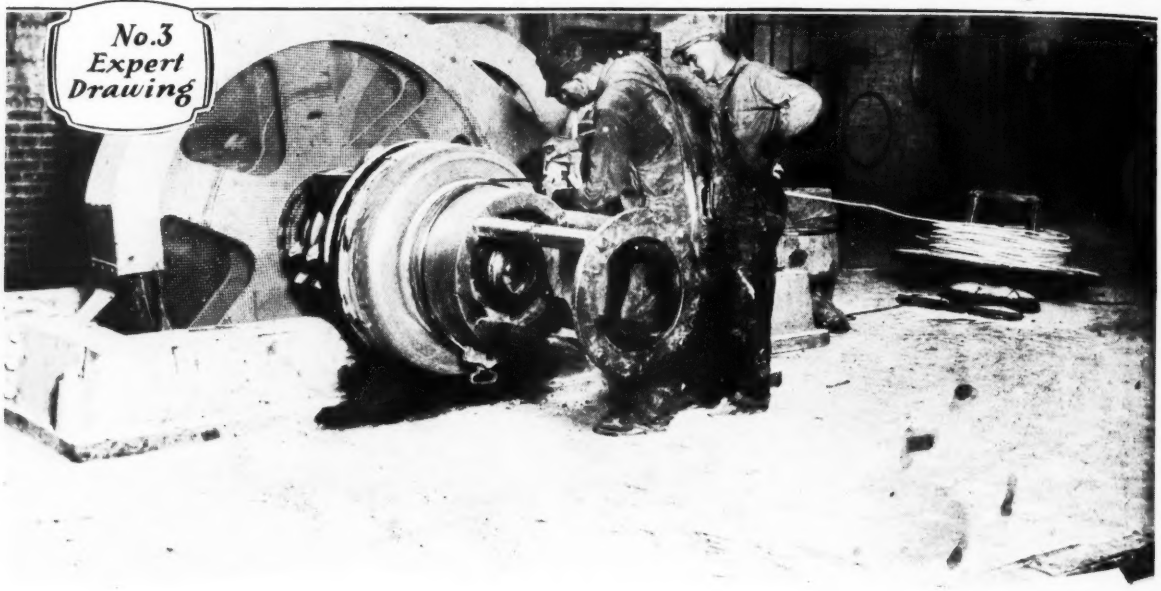


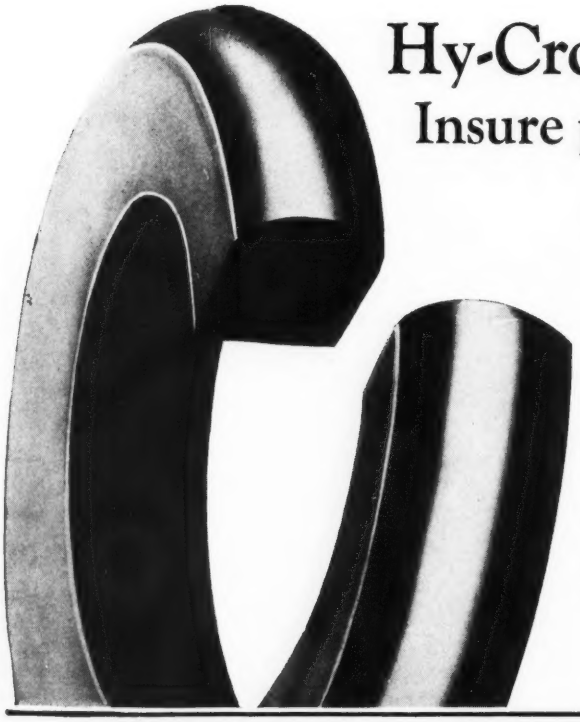

## Hy-Crome Spring Washers
### Insure positive rail joint security

ABOVE illustration shows our Bull Dog Cold Drawing Mill used exclusively for drawing the rods from which HY-CROME SPRING WASHERS are made.

It requires three separate passes through this mill with a thorough annealing after each drawing to shape the round rod into a keystone section.

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**The Reliance Manufacturing Co.**
**Massillon, Ohio**

# HY-CROME

*"The Most of the Best for the Least"*


RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

Alphabetical Index to Advertisers, Page 70 Classified Index to Advertisers, 66-68

# An Announcement

Two names—long famous for devotion to high ideals of quality and service—are now combined.

Fairmont Railway Motors, Inc., Fairmont, Minnesota, and Mudge & Company, Chicago, Ill., have brought together their resources and facilities and will operate under the one name—

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Combined facilities, with manufacturing plants located at Fairmont and Chicago, will assure our customers a most superior type of motor car service.

We appreciate the confidence of our many friends and pledge ourselves to justify and strengthen this confidence.

Performance *on the Job* Counts

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**Railway Engineering and Maintenance**

*Formerly the Railway Maintenance Engineer*

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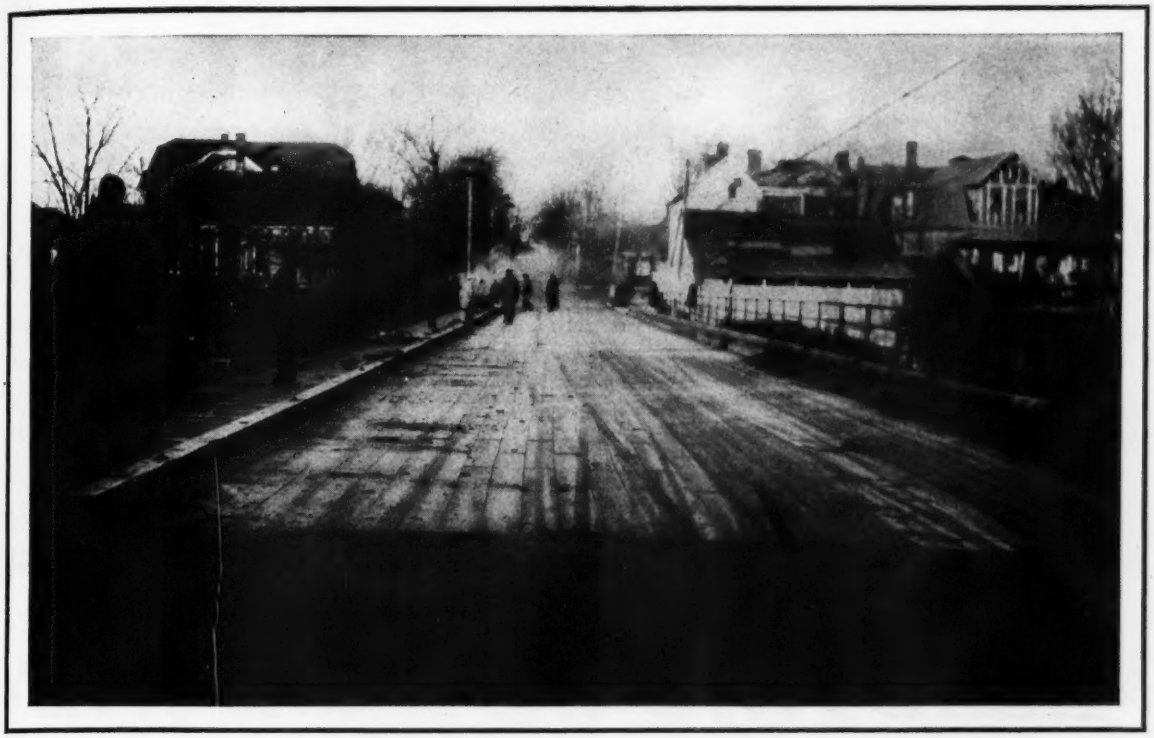

*A view of the I.C.R.R. Bridge at Ripley, Tennessee. An overhead crossing paved with Carey Elastite Bridge Flooring.*

# Now... for paving *all* traffic surfaces--

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Carey Elastite Bridge Flooring is economical. For its attention-free, dependable service repays its cost many times over. Easily installed, with ordinary tools. Undisturbed by the climatic changes, and it knits and heals under traffic. Write for particulars.

*Also manufacturers of Carey Elastite Water-proofing Protection Course, Carey Elastite Track Paving, and Carey Elastite Trunking.*

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*Lockland, Cincinnati, Ohio*

Carey Elastite

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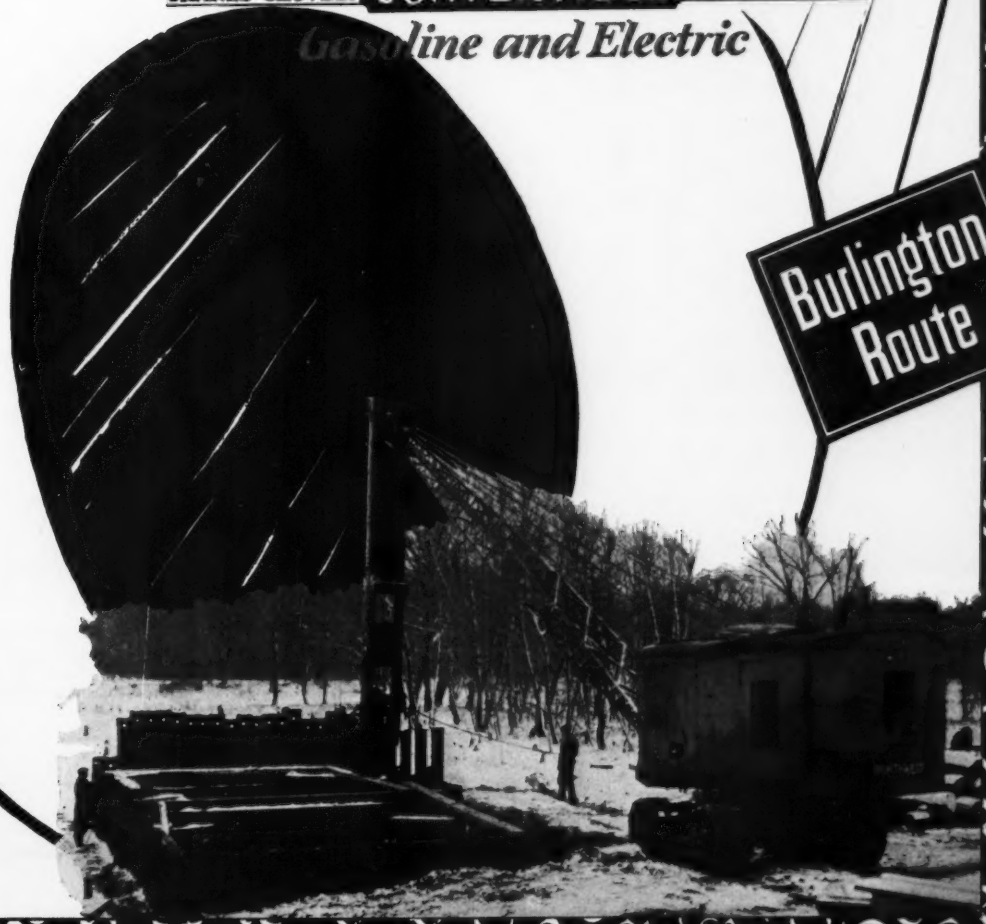


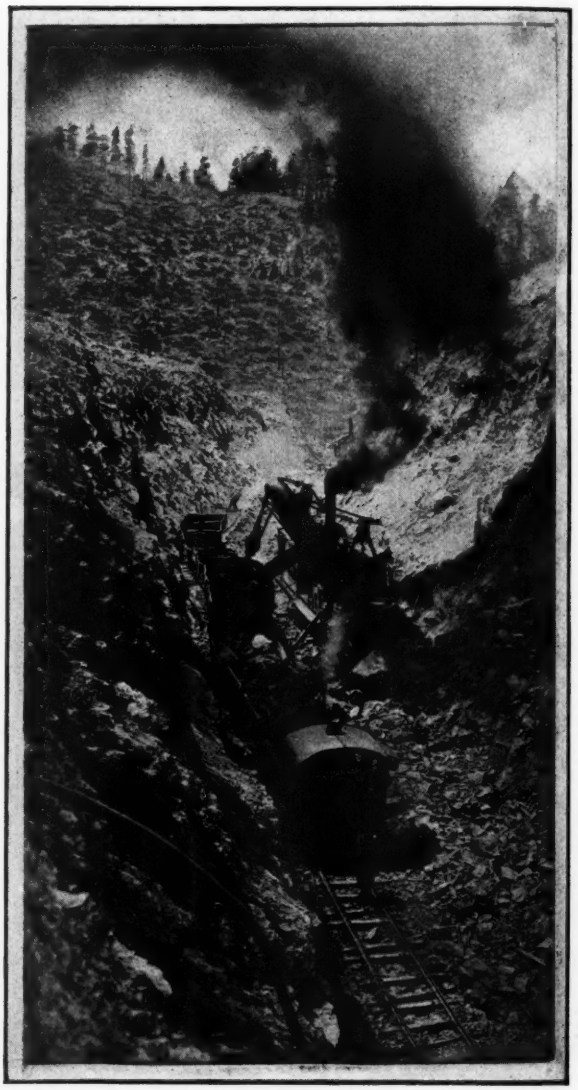

*Driving steel sheeting for bridge piers at Alma, Wis.*

REM6—Gray

# MORE DYNAMITE

## *A group of* NEW *du Pont*

*North Tunnel; New York and New Jersey shields of the Holland Vehicular Tunnel, the day prior to their junction. Booth and Flinn, Ltd., contractors. Rock obst uctions blasted with du Pont Dynamite.*



*200,000 pounds of du Pont explosives were used to shatter 80,000 cubic yards of lava rock in the Southern Pacific Railway's cut-off between Black Butte and Grass Lake, Ore.—Heiselt Construction Company.*

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E. I. DU PONT DE NEMOURS & CO., Inc.

*Explosives Department*

WILMINGTON, DELAWARE

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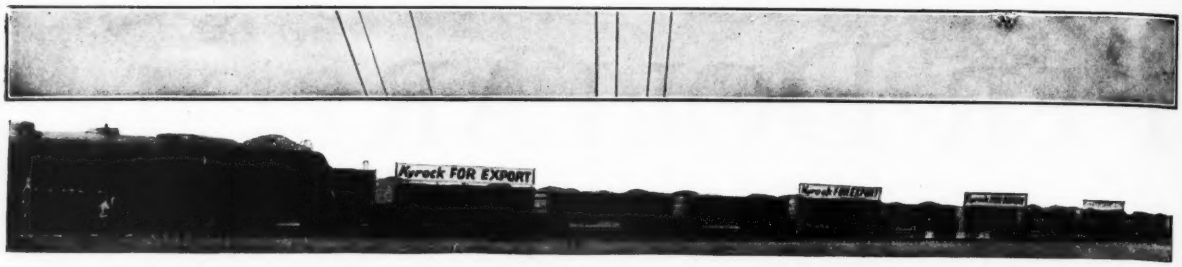


*One of two trains of 44 cars of Kyrock loaded out on March 30, 1928, for paving 30,000 sq. yds. of streets in a South American city.*

*Loading Kyrock at the plant. The barge is kept in constant motion under the delivery chute (note the ridges) to insure a thorough mixing. Just one of the many exclusive operations that enable us to guarantee Kyrock uniformity.*

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# Kyrock

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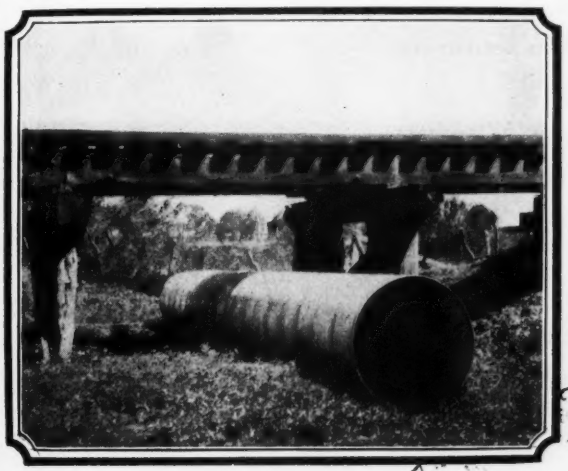
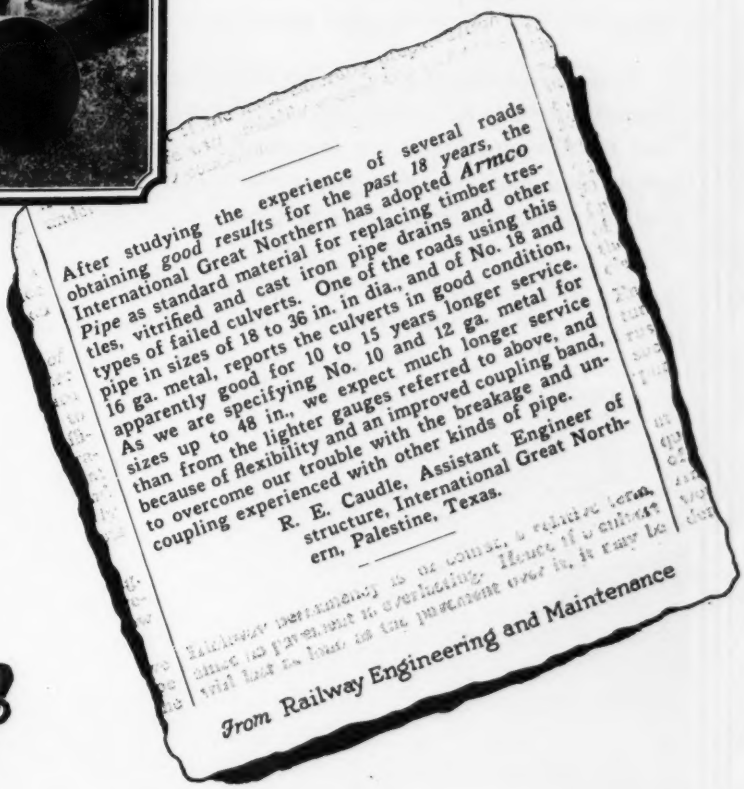
KENTUCKY ROCK Kyrock ASPHALT

# Let Armco *flexibility* give you *a safe replacement for open trestles*




After studying the experience of several roads obtaining good results for the past 18 years, the International Great Northern has adopted Armco Pipe as standard material for replacing timber trestles, vitrified and cast iron pipe drains and other types of failed culverts. One of the roads using this pipe in sizes of 18 to 36 in. in dia., and of No. 18 and 16 ga. metal, reports the culverts in good condition, apparently good for 10 to 15 years longer service. As we are specifying No. 10 and 12 ga. metal for sizes up to 48 in., we expect much longer service than from the lighter gauges referred to above, and because of flexibility and an improved coupling band, to overcome our trouble with the breakage and uncoupling experienced with other kinds of pipe.
R. E. Caudle, Assistant Engineer of structure, International Great Northern, Palestine, Texas.
From Railway Engineering and Maintenance

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Data on how other railroads have carried out trestle replacements as above outlined will be sent you on request. Suggestions of our engineers on specific replacement problems are at your disposal also. No obligation.

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

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*Flexibility for safety and economy in underground construction*

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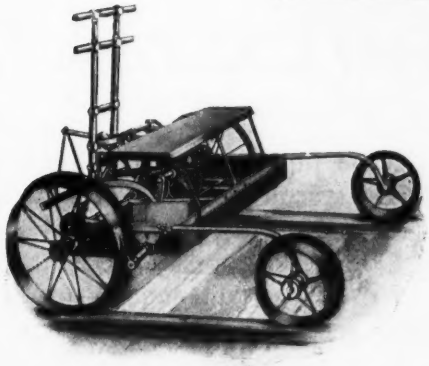
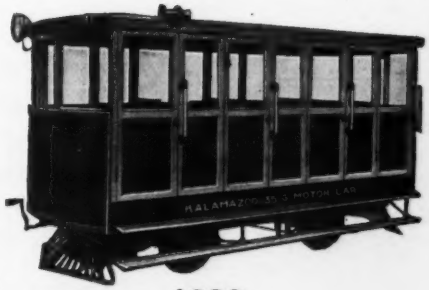


1883



1928

A complete line of hand operated and motor cars, and other maintenance equipment.

A record of nearly half a century of continuous, progressive service to the railways of the world.

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*Established 1883*

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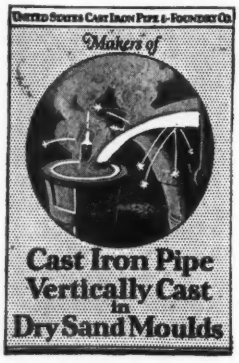
*Part of 9 miles of 16" de Lavaud pipe, Class 100, recently laid in Tulsa, Oklahoma*

# 5% extra carrying capacity with no extra Cost




*Much helpful data for the engineer is contained in the U. S. Cast Iron Pipe Handbook. Write for your copy now*

SIZE for size, deLavaud pipe has a larger internal diameter than other cast iron pipe. The great strength of deLavaud pipe, the uniformity of the metal and its freedom from defects make this possible. And the extra carrying capacity of the larger diameter is further increased by the smooth interior surface of the pipe.

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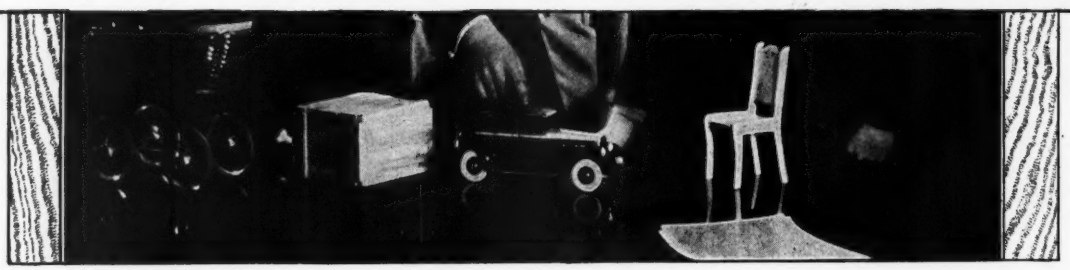

FROM shipping cases to auto bodies — there's a better way to use wood.

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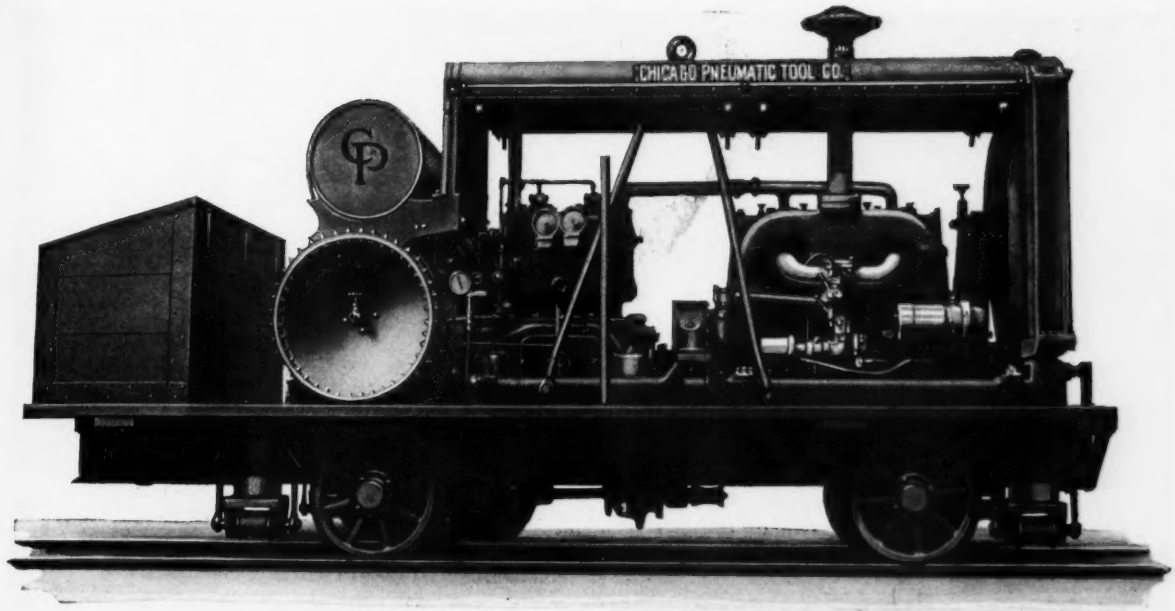
AMERICAN STANDARD LUMBER FROM AMERICA'S BEST MILLS

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Our many years' experience in building air compressors of all types has been combined with the practical suggestions of experienced railroad men who have assisted in the design of this new complete unit. It is built in sizes of 100, 160, 220 and 310 cubic feet per minute displacement. The standard CP gasoline engine driven portable compressor with its famous Simplate Valve, Auto-Pneumatic throttle and other exclusive features, is mounted on a truck frame carrying flanged wheels with Timken roller bearings, transverse shifting wheels, a transverse towing winch and air operated lifting jacks. The car is propelled at a speed of 12 to 18 miles per hour, depending upon the size. These and other interesting features of this latest CP development are illustrated and described in Bulletin No. 789 which will be sent upon request.

C-279

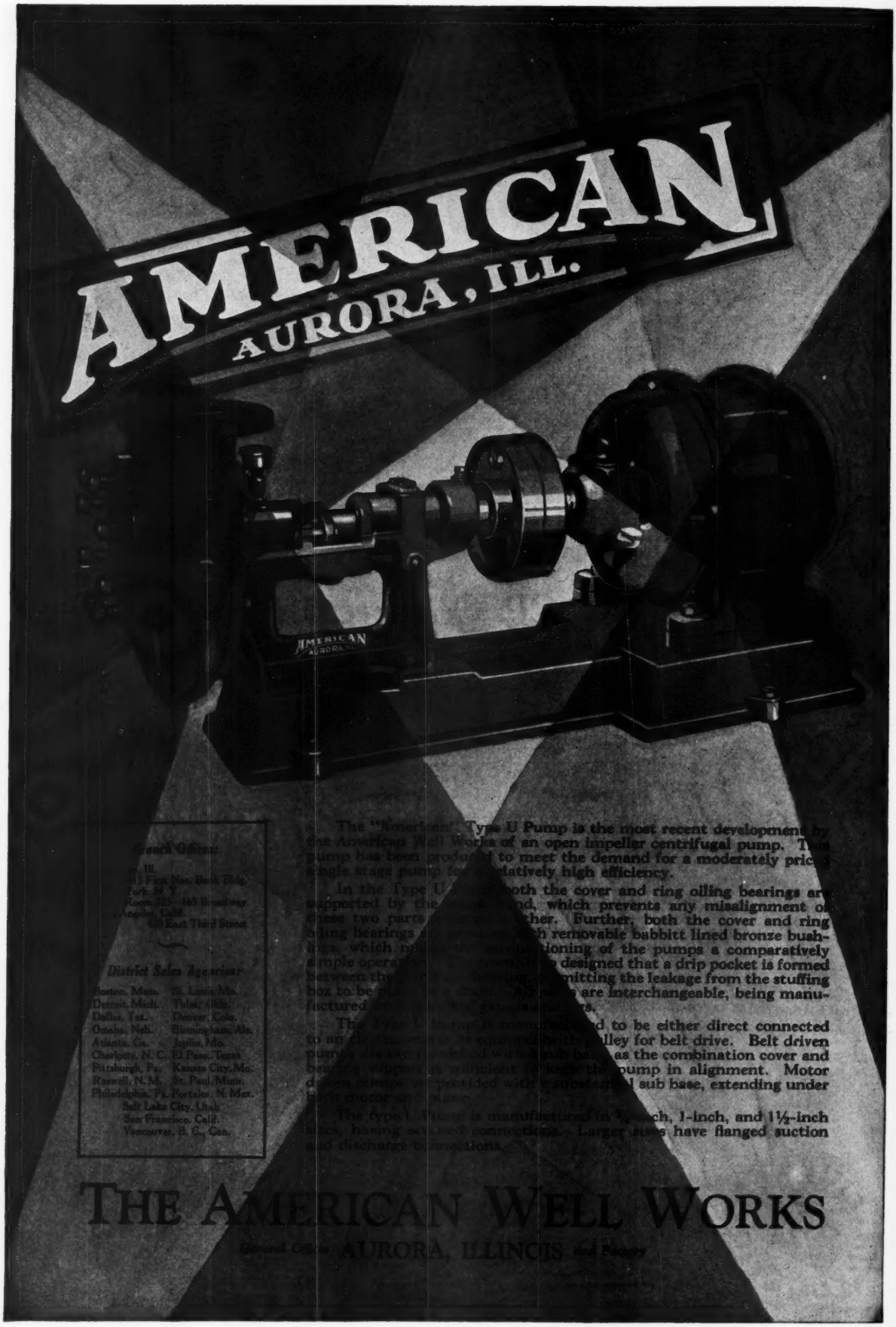
CHICAGO PNEUMATIC

## Chicago Pneumatic Tool Co.

Railroad Department

6 East 44th St. New York | 1004 Mutual Bldg. Richmond, Va. | 310 S. Michigan Ave. Chicago

CHICAGO PNEUMATIC

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...The "American" Type U Pump is the most recent development by the American Well Works of an open impeller centrifugal pump. This pump has been produced to meet the demand for a moderately priced single stage pump for relatively high efficiency.

...In the Type U ... both the cover and ring oiling bearings are supported by the ..., which prevents any misalignment of these two parts ...ther. Further, both the cover and ring oiling bearings ... with removable babbitt lined bronze bushings, which ... tioning of the pumps a comparatively simple operat... designed that a drip pocket is formed between the ... mitting the leakage from the stuffing box to be ... are interchangeable, being manufactured ...

The ... d to be either direct connected to an ... ...lley for belt drive. Belt driven pumps ... as the combination cover and bearing ... pump in alignment. Motor driven ... sub base, extending under both motor and pump.

The ... ch, 1-inch, and 1½-inch sizes, having screwed connections. Larger sizes have flanged suction and discharge connections.

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General Offices AURORA, ILLINOIS and Factory

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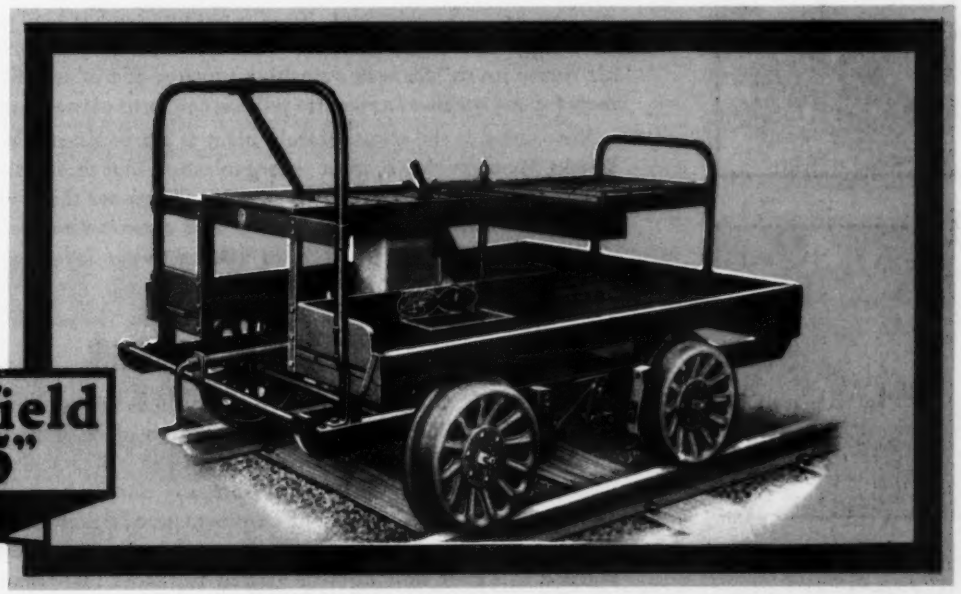


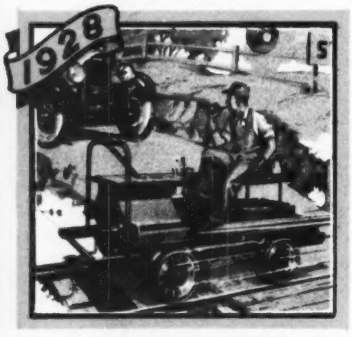

**"FIRST ON THE RAILS – AND STILL FIRST"**

# *The Sheffield* "Story of Leadership"

Sheffield

Always there is a leader in every industry. And that leadership must be *earned.* The company which makes the contributions in its field—which bears the burden of expense and effort for the Research and development which make for Progress has the *right* to that leadership.

## The Organization




Shake hands with Sheffield men!

The one that calls upon you to discuss your motor car, trailer or push-car needs is your point of contact with an organization that has made the contributions to the transportation problems of railroads. Call him a "salesman," if you like, for he is a salesman. He sells nothing but Sheffield products. His time, his energy, his enthusiasm are devoted to this single phase of railroading. From his "close touch" he is in a position to serve you in selecting the right equipment for any specific service. He sells on one basis alone—*your future satisfaction.*

Now come to the huge Sheffield plant at Three Rivers, Michigan. From its Works Manager down, meet an organization that thinks and works in terms of Sheffield application to railroad needs. There are thirty-two years of experience behind that plant organization. *This organization has made the contributions that have given railroads the efficient motor cars, trailers, etc., that are available today.*

## Facilities of Progress

In this plant devoted exclusively to the manufacture of Sheffield products are seen the facilities which unlimited capital can place in the hands of its organization. Constant research for improvement. Manufacturing facilities and methods for making available to railroads Sheffield products *at the lowest price consistent with quality.* The employment of jigs, fixtures and dies for the precision which spells longer service and accurate interchangeability has, reached a higher development than in any other plant manufacturing similar products.

But not all of this plant's facilities are within its own borders. The Fairbanks-Morse Company—first in the United States to manufacture commercially an internal combustion engine using liquid fuel—lends its gigantic resources of experience and engineering talent to its Sheffield Division.

# Research—Engineering

"Watch Sheffield—and you watch motor car progress." The maintenance of this Sheffield slogan has been the aim and attainment of Sheffield Research and Engineering.

On a one-half mile circular track and other trackage containing every type and degree of curve, and grades up to seven per cent, a projected model must prove its right to the Sheffield name. Here also, Sheffield products meet the final test before going to the purchaser.

And on this proving ground Sheffield has avoided many an impractical construction which time and service later proved as only worthy of Sheffield's advance discard.

Sheffield engineers have drawn carefully the distinction between interchangeability and a mere adaptation. In the full line of Sheffield products there is a motor car, trailer or push-car to better fill every need for any particular service without compromise.

# Service that follows a "Sheffield"

Sheffield service begins before you purchase. It aids you in securing the right type of equipment but it follows each Sheffield product after the purchase through its entire life of service. Sheffield men are found in the field helping those who use "Sheffields" to get the most from them—helping railroad men in charge of maintenance to get all the performance and service that is built into these products. Sheffield service is not theoretical—a Sheffield man actually helps in overalls and sleeves "rolled up" if need be.

And should mishap occur to a Sheffield product, Sheffield service gets the equipment back in service quickly and promptly. When your road purchases a "Sheffield," it is in reality purchasing more than equipment—it is buying *Transportation.*

# The Sheffield Guaranty

This unequaled power of Organization and Facilities which is Sheffield is behind every Sheffield product. It in itself, is your best guaranty of Sheffield value. The Sheffield guaranty is built into Sheffield products at the factory. It is followed by the *desire* that Sheffield equipment give you every service you can expect from a finely built mechanism. It is fulfilled by the *ability* of Sheffield to make good its guaranty.

*The Sheffield leadership is founded upon customer satisfaction*
*—and Sheffield never endangers that leadership*

# FAIRBANKS-MORSE

## MOTOR CARS - - - - - TRAILERS
## VELOCIPEDES - - - PUSH CARS
## STANDPIPES - - TANK FIXTURES

## "Firsts"

*(Just a few of them)*

1. First railroad gasoline motor car.
2. First air-cooled gasoline engine for railway motor car use.
3. First three-wheel railway motor car.
4. First to use a four-cycle engine in railway motor car.
5. First two-cylinder motor car engine.
6. First direct drive railway motor car.
7. First wooden frame railway motor car.
8. First center-load railway motor car.
9. First four-wheel railway motor car.
10. First to use a water-cooled engine in railway motor car.
11. First gear-drive railway motor car.
12. First chain-drive railway motor car.
13. First railway section or bridge gang motor car.
14. First railway gasoline motor car equipped with a free-running engine.
15. First railway gasoline motor car equipped with a planetary transmission.
16. First railway motor car to be equipped with a float-feed carburetor.
17. First four-cylinder railway motor car.
18. First railway gasoline motor car capable of equal speeds in either direction.
19. First clutch-drive motor car.
20. First friction-drive motor car.
21. First air-cooled, free-running engine installed in a railway motor car.
22. First railway motor car equipped with a two-cycle engine.
23. First railway motor car equipped with a brake which is adapted to be operated by shifting the lever in either direction.
24. First railway motor car equipped with individual ignition cut out switches for the various cylinders.

"Sheffield

# More Downright value

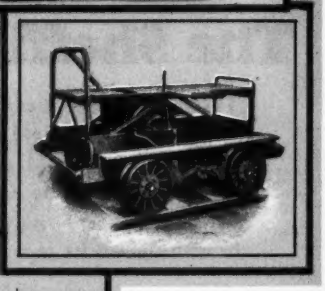
It is not design alone, nor construction, nor workmanship, nor quality of materials that determines the value of a section car, but rather the sum total of *all* these vital factors. And since Sheffield motor cars are the product of greater experience and facilities, they represent a dollar-for-dollar value that would ordinarily be impossible.

To fully appreciate this *plus* value you must look beyond the mere outward evidences of quality construction—even beyond the advanced design. For it is in the many refinements of *detail* that the true value of Sheffield cars is found.

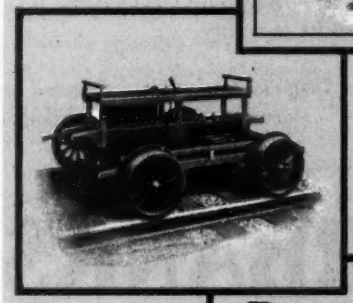
Just as Sheffield *performance* is a result of advanced design, Sheffield *value* is a result of countless refinements of practical value!

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., Chicago, Ill.

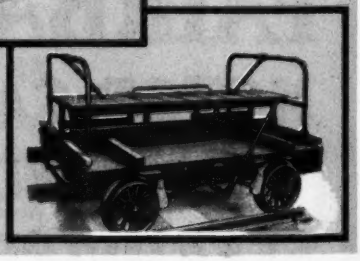
**SHEFFIELD "40-B"** *Two-cylinder, four-cycle valve-in-head motor. Simplified friction transmission. Three-point engine suspension. Timken Tapered Bearings on crank-shaft and wheels. Auto-type pressed steel frames. The fine car of section cars.*



**THE SHEFFIELD "44"** *Powerful, one-cylinder, two-cycle, water-cooled, fuel-saving motor. Positive chain drive operated by a clutch that is a real engineering achievement; clutch can be slipped freely, affords greater flexibility of control.*



**SHEFFIELD "41"** *The most popular center-load light inspection car on the market. Has a simple, easy-starting, two-cylinder, air-cooled engine.*



*Trailer completely equipped with rigidly built, removable seat top section, side steps, brakes, Sheffield pressed-steel ground tread wheels and Timken Tapered Roller Bearings.*

TIMKEN BEARING EQUIPPED

# FAIRBANKS-MORSE

ARA21.39

The Woodings one-piece anti-creeper is applied quickly at little expense by means of a light tool which is proving very satisfactory due to the ease with which the anchor is put on the rail.

## The Large Loop Grips Rail Firmly and Provides Good Bearing Surface Against the Tie

THIS improved Woodings Rail Anchor with the large loop is very effective and holds the most difficult track from creeping.

The hook at one end engages the upper side of the rail firmly. The adjacent portion makes contact with the underface of the rail at two points. It clamps and grips the rail with enormous pressure at both sides by its own resiliency. The very deep loop gives a large and effective bearing surface against the tie which assures a strong and positive anchorage.

This anchor is now in service on 21 railroads and is considered one of the best anchors in service by some of the most prominent engineers of maintenance of way.

*Why not try them on any track which is difficult to hold?*

## Woodings Forge and Tool Co.

*Works and General Sales Office*

**Verona, Pa.**

# WOODINGS RAIL ANCHORS

METALWELD WORTHINGTON
M-W

**1** **Laidlaw Feather Valves**—Patented — consisting of double strip steel, with forged steel valve seat. Lowest replacement cost of any valve made. Over 750,000 of these valves in use.

**2** **Forced Feed Lubrication**—by direct plunger pump on crank shaft. Positive oil feed to all main, connecting rod bearings and wrist pins.

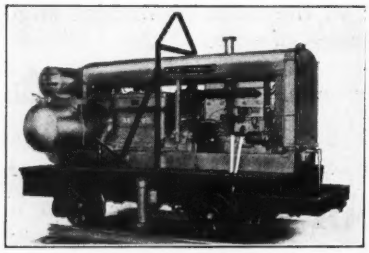
**3** **Crank Shaft**—45 per cent caroon steel; extra large main and rod bearings. No vibration, due to careful counterbalancing of crankshaft.

**4** **Cooling System** — Extra large water jackets running from top to bottom of piston travel. Water circulation by direct-driven pump on gasoline engine.

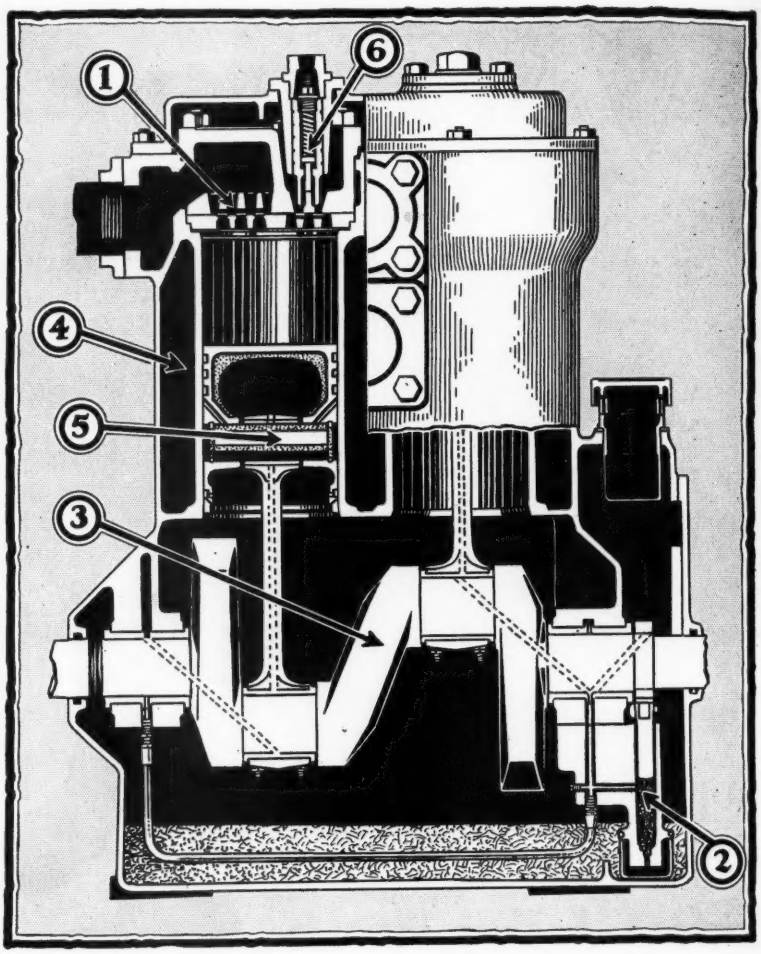
**5** **Four Ring Auto-Type Pistons** with full floating wrist pin. Extra large oil reservoir and oil baffle plates at bottom of piston travel.

**6** **Bronze Piston Type Unloader** with piston rings. Insures perfect seal of inlet valves during unloading period.

**Other features include Automatic Engine Throttle Control, Electric Starters, All-welded Frame, and Full Sectional Radiator. 110 and 210 cu. ft. machines are equipped with Duplex (2 Cylinder) Compressors; 280 and 330 cu. ft. sizes equipped with Triplex (3 Cylinder) Compressor.**



**M-W 280 cu. ft. RAILCAR**
M-W Portables are available in Self-Propelled "Towabout" and Rail Car Mountings.




# FORCED FEED LUBRICATION

Every M-W Portable Air Compressor unit embodies the valuable feature of Forced Feed Lubrication throughout both engine and compressor. This is the ideal system for portable work in railway maintenance as well as in general construction work, as effective lubrication is assured at all times, whether the machine is standing level or not.

Forced feed lubrication forces oil under pressure from an eccentric yoke pump on the crank shaft direct to every moving part of the compressor. If the oil level runs low it is immediately indicated on the pressure gage.

* * *

This outlines but one of the many important M-W Features of Design. Other outstanding features, making the M-W the most popular Portable Air Compressor built, are listed above.

Fully illustrated Bulletins on the entire M-W line—from 110 to 330 cu. ft. sizes —are mailed free on request.

**METALWELD, INC.**
**26th and Hunting Park Ave., Philadelphia, Pa.**
***(Dealers in all principal cities)***

# Metalweld-Worthington
## *Portable Air Compressors*

# Learn the ESSENTIALS when you start out to buy fence

START with the assumption that a fence, to give long-time property protection, must embody certain essentials of construction. Such features, for example, as copper-bearing steel, galvanizing after weaving, full-weight materials, concrete post foundations.

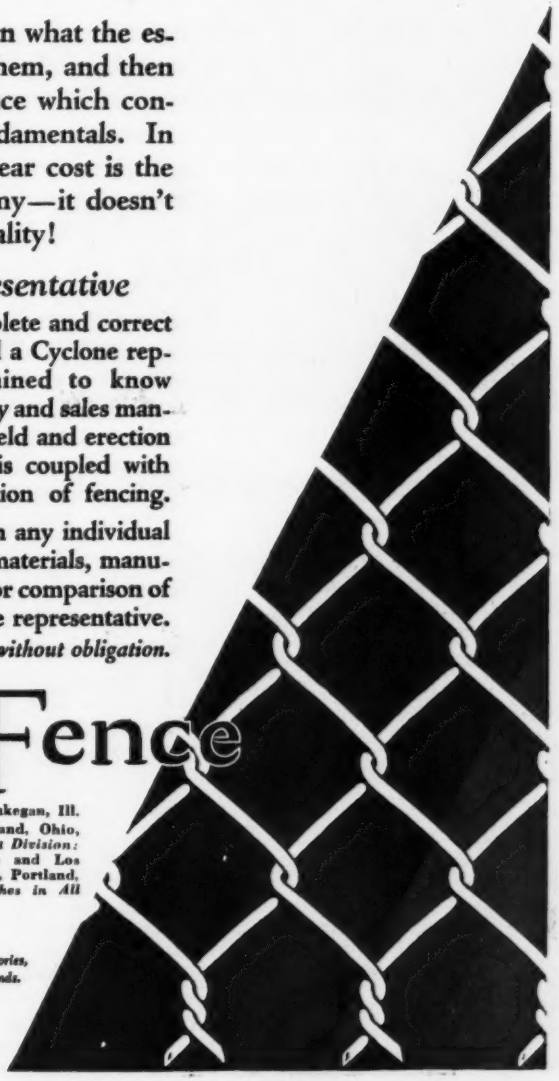
Start with that premise, learn what the essentials are, make a list of them, and then decide to accept only a fence which conforms strictly to those fundamentals. In buying fence — where per-year cost is the only real criterion of economy—it doesn't pay to compromise with quality!

## *Call a Cyclone Representative*

The quickest way to get a complete and correct understanding of fence is to call a Cyclone representative. Our men are trained to know fence. Trained not by desk study and sales manuals, but through actual shop, field and erection work. This intensive training is coupled with long experience in the application of fencing.

If you want facts on fence — on any individual requirement, on differences in materials, manufacture and erection as a basis for comparison of true fence values—call a Cyclone representative.

***Write, phone, or wire nearest offices without obligation.***



# Cyclone Fence

REG. U.S. PAT. OFF.

CYCLONE FENCE COMPANY *Main Offices:* Waukegan, Ill. *Works and Offices:* North Chicago, Ill., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas. *Pacific Coast Division:* Standard Fence Co., Oakland, San Francisco and Los Angeles, Calif., Northwest Fence & Wire Works, Portland, Oregon, Seattle, Wash. *Direct Factory Branches in All Principal Cities.*

*Fencing for residences, estates, schools,*

*playgrounds, factories, property of all kinds.*

*The Mark of Dependable Property Protection*

© C. F. Co., 1928

McWILLIAMS "MOLE"

The Mole automatically excavates and thoroughly cleans every foot of ballast clearing trains on all tracks while in operation.

*Average labor cost is less than five cents per lineal foot of entire track space cleaned*

Mole can be easily transferred over obstructions by means of portable transfer truck. No work train service required.

Sections of interlocking tread rail are taken up behind the Mole and laid down ahead as machine progresses.

Dirt taken from ballast by the Mole is removed in carry boxes by workmen.

Large laboring gangs like this are unnecessary with the Mole Only 6 men and an operator are needed.

The McWilliams Mole is the most economical and efficient ballast cleaning machine ever used in railroad service. Total cost of operation, including initial investment and depreciation, is less than 10% of hand labor costs, 50% less than locomotive crane operation and in addition cleans the ballast far more thoroughly than ever before.

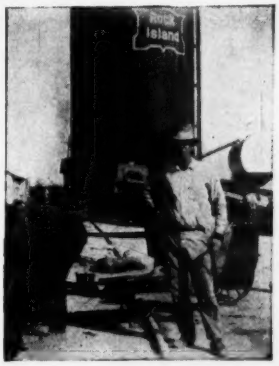
A new descriptive Bulletin is available to all interested upon request.

RAILWAY MAINTENANCE CORPORATION

PITTSBURGH, PA., U. S. A.

28-Day Strength in 24 hours

# Pavement Used 24 Hours
## *after concrete is placed*




CONTINUOUS incoming freight made it necessary to keep this Rock Island freight house accessible at all times. So Quikard Cement was used for constructing the new platform approach. And it was opened to heavy freight hauling traffic just 24 hours after being finished. Such speedy construction is continually being accomplished with Quikard Cement—and with safety. For this proved quick-hardening cement produces 28-day strength in 24 hours. And it is a true Portland Cement—requires no admixtures or accelerators.

Mixed in standard proportions, Quikard attains this tremendous early strength and develops increased strength thereafter. It not only meets U. S. Govt. and A. S. T. M. standard specifications for Portland Cement, but exceeds all strength requirements.

Quikard is *not* quick-setting. It takes its initial and final set normally, allowing plenty of time for proper mixing, placing and finishing. It is plastic, easily finished, dependably uniform. It produces an exceptionally waterproof concrete that forms a perfect bond with new or old Portland Cement concrete.

Quikard will save *you* from 3 to 4 weeks' time in any type of concrete construction. Use it next time for speedy work with safety.

### *Write for Facts*

Get all the facts about this proved quick-hardening cement. Learn how it will save you from three to four weeks' time in any type of concrete construction. Write today for complete information and illustrated literature describing its successful use on important jobs.

*Produced Only by*
ASH GROVE LIME & PORTLAND CEMENT CO.
*Founded in 1882*
615 Grand Avenue Temple, KANSAS CITY, MO.

QUIKARD CEMENT

15

# The answer to real shovel economy

1921

**O·AMES SHOVELS**

**SHOVELS-SPADES-SCOOPS**

*At good supply houses everywhere*

AMES SHOVEL AND TOOL CO. · · Ames Bldg., Boston

Owners of Oliver Ames & Sons Corp., North Easton, Mass. Est. 1774

# The Milk Train
## *carrier of good health*

**2,750,000 quarts of milk, New York City's daily supply, is brought in every night by the railroads from an average distance of 200 miles. Much of it travels 500 miles. Yet New York is reputed to have a purer milk supply than any other city in the world.**

**Recently a milk tank-car, carrying 12,000 quarts of fresh milk in two large glass-lined tanks, ran from Wisconsin to Florida, a distance of 1,800 miles, in 101 hours. With a change of temperature of 68 degrees outside, the temperature of the milk rose only one degree.**

**Such efficiency by the railroads in the transportation of food supplies has contributed greatly to the nation's health.**

**By supplying the oxwelding needs of railroads controlling a majority of the trackage in the country, the Oxweld Railroad Service Company has had a part in the development of modern railroading. Fifteen years of service has proved the value of an Oxweld Railroad Service contract.**

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY
*Unit of Union Carbide and Carbon Corporation*
UCC
New York City: Carbide and Carbon Building
Chicago: Railway Exchange

# Specify

# Casey Jo

## Product of NORTHWESTERN MO

**Advanced Engineering and mechanical improvements ahead of all others, is the keystone of Casey Jones success.**

**An openminded organization, alert to grasp the recommendations of experienced railway men, co-operates with a keen and sensible engineering staff to produce a product of marked superiority.**

**The general acceptance of Casey Jones as the improved standard of most leading railways is a tribute to this engineering leadership.**

**APPLY FOR ENGINEERING DATA AND PRICES**

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1803 CANAL BANK BLDG.

**NORTHWESTERN MOTOR COMPANY**

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an investment in permanent satisfaction—

TOR COMPANY, Eau Claire, Wis.

Every Casey Jones Motor Car is properly designed for a distinct class of service. The proper application of railway motor car power yields the best results.

You can safely specify Casey Jones with the assurance of complete satisfaction, of lowest first cost, of lowest cost of operation and lowest cost of replacement parts.

THE RIGHT TYPE OF CAR FOR EVERY CLASS OF SERVICE

| CLASS | TYPE | H. P. | CAPACITY | SERVICE |
|---|---|---|---|---|
| CLASS A | Casey Jones 551 | 22 | 4 TO 150-MEN TRAILERS | HEAVY DUTY |
| CLASS BB | Casey Jones 523 | 8 | 2 TO 60-MEN TRAILERS | EXTRA LARGE SECTION |
| CLASS B | Casey Jones 521 | 6 | 2 TO 30-MEN TRAILERS | STANDARD SECTION |
| CLASS C | Casey Jones 531 | 4 | 1 TO 4 MEN | LIGHT INSPECTION |

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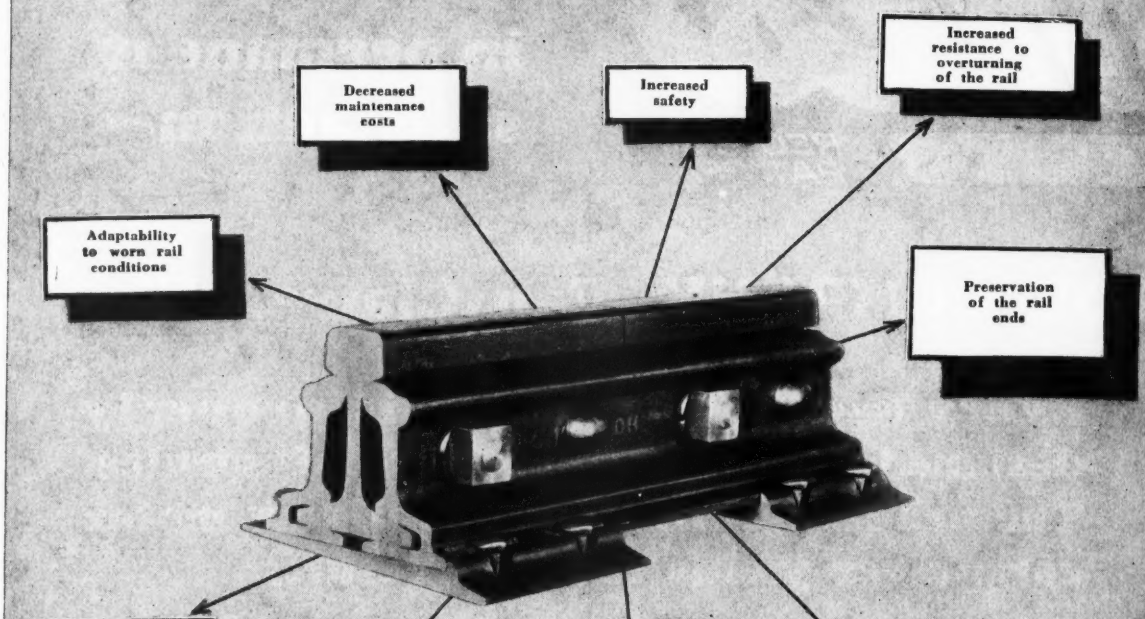
FOREIGN
KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.
KOPPEL, PA.

Factory and Home Office: Eau Claire, Wis.

# HEAD FREE
## CONTINUOUS JOINT


Decreased maintenance costs
Increased safety
Increased resistance to overturning of the rail
Adaptability to worn rail conditions
Preservation of the rail ends
Tighter under load than unloaded
Absolute maintenance of line and surface of the abutting rail ends
Increased effective strength of the head of the splice bar
Elimination of anvil pounding under the rail head

Keeping Pace With Progress

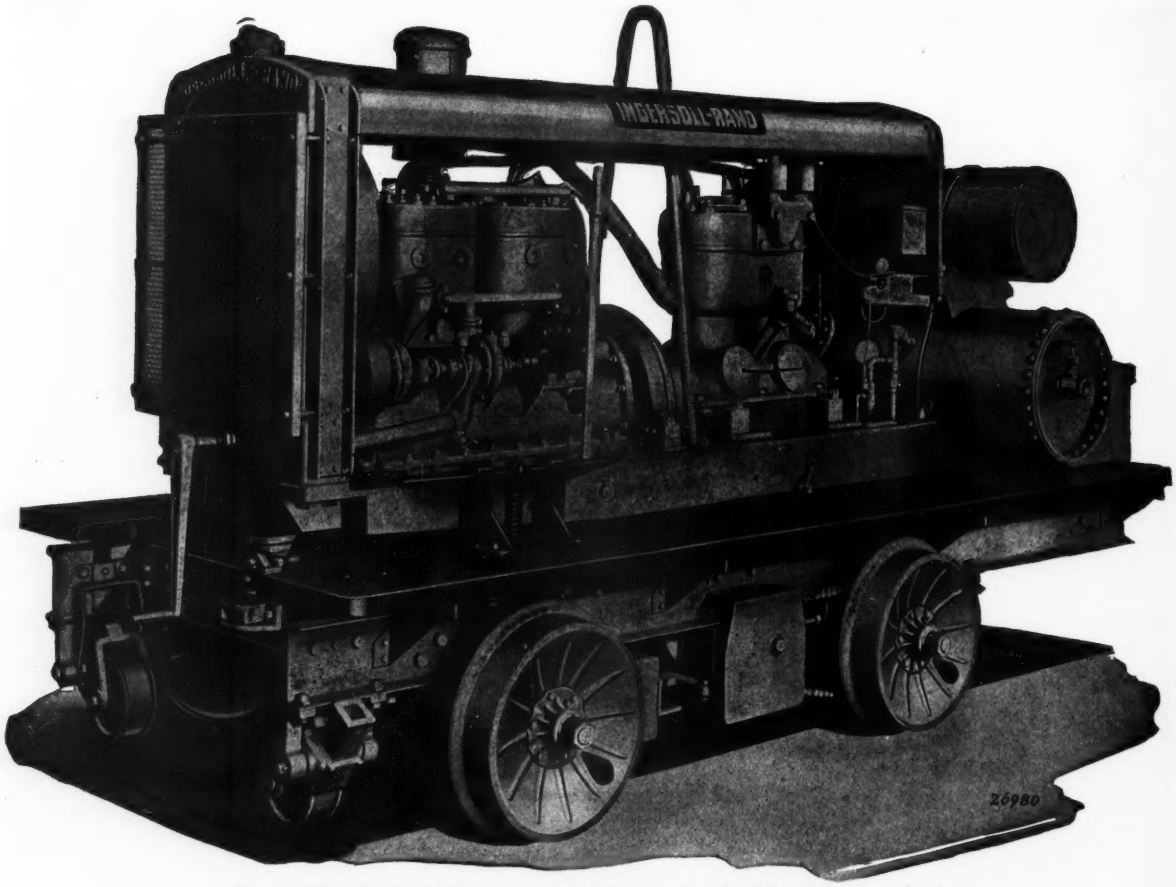
THE RAIL JOINT COMPANY
165 Broadway, New York, N. Y.

# every railroad official should ask

Can maintenance be lowered by the judicious use of alloy steel? Illinois Steel engineers will gladly co-operate in furnishing the answer. . . . Address

## Illinois Steel Company

General Offices:
208 South La Salle Street
Chicago, Illinois




*Ingersoll-Rand 8 Tool Tie Tamper Air Compressor with self-propelling mechanism*

# Another Big Improvement In Railway Portable Compressors!

Ingersoll-Rand Self-Propelled Tie Tamper Compressors are now equipped with an air motor for driving the compressor car. The air motor is of the four-cylinder type, and the driving mechanism is a sprocket and chain arrangement direct from the air motor to the axle.

This drive gives a wider range of speed and better control. The air motor also serves as an auxiliary brake on descending grades. There are no gears to engage or strip—no clutch to get out of order.

*Other features include:* (1) swivel-type transverse wheels, which also serve as lifting jacks and eliminate the need for hydraulic, pneumatic, or other types of lifting jacks; (2) draw-bar connection on both ends of car for towing; (3) three-point mounting of compressor on railway car.

*New features*—improved design—better materials—all make Ingersoll-Rand Tie Tamper Compressors the most modern and economical machines for railway work. Ask for complete information.

Ingersoll-Rand Company is the pioneer in the development and introduction of labor-aiding compressed air equipment for railroad track construction and maintenance. By reason of its long experience, Ingersoll-Rand can offer a superior service—one which will help produce the best results with such equipment.

INGERSOLL-RAND COMPANY—11 BROADWAY, NEW YORK CITY

*Offices in principal cities the world over*

For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

155-TT

**Ingersoll-Rand**

# MASSEY

## Precast Concrete Products

Battery Boxes

Battery Wells

Cable Posts

Cable Test Houses

Cattle Passes

Cribbing

Culverts

Junction Boxes

Precast Passageway

makes an ideal underpass for terminals, yards, stations, etc.

Manholes

Piling

Signal Cellars

Signal Foundations

Switchmen's Houses

Telephone Booths

Telegraph and Telephone Poles

Transformer Stations

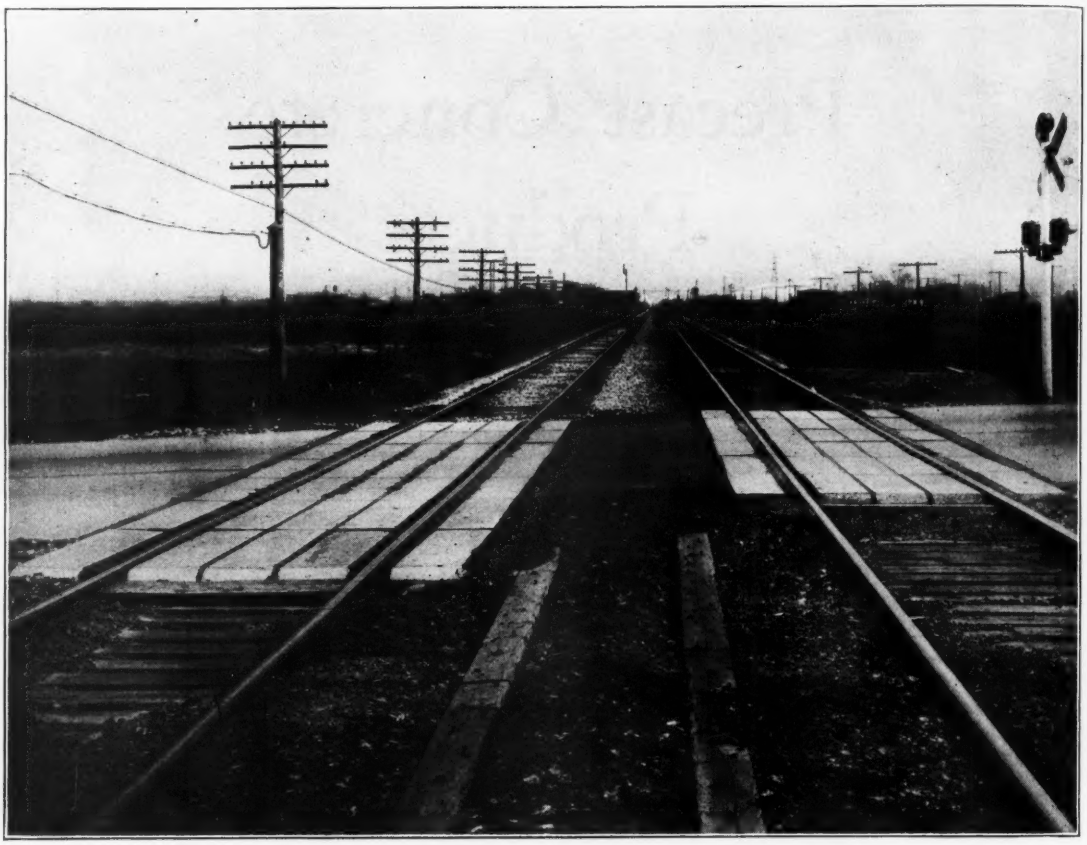
## Massey Concrete Products Corporation

Peoples Gas Building, Chicago

Sales Offices: New York, Atlanta, Cincinnati, St. Louis, Los Angeles
Canadian Concrete Products Co., Limited, Transportation Building, Montreal, Que.

R E M 6-Gray

# PERMANENT CONCRETE PRODUCTS



Concrete slabs for railway and highway crossings, mile posts, whistle posts, rail rests, fence posts—

Everything in pre-cast concrete products.

## THE PRENDERGAST COMPANY

MARION OHIO

*Sole Agents*

TONCAN
COPPER
Mo-lyb-den-um
IRON

Following are the makers of Toncan Culverts. Write the nearest one:

Beall Pipe & Tank Corp. Portland, Ore.
The Berger Mfg. Co., of Mass. Boston, Mass.
The Berger Manufacturing Co. Dallas, Texas
The Berger Manufacturing Co. Jacksonville, Florida
The Berger Manufacturing Co Minneapolis, Minn.
The Berger Manufacturing Co. Philadelphia, Pa.
The Berger Manufacturing Co. Roanoke, Virginia
The Canton Culvert & Silo Co. Canton, Ohio
The Firman L. Carswell Mfg. Co. Kansas City, Kan.
The Pedlar People Limited, Oshawa, Ontario, Canada
Superior Culvert & Flume Mfg. Co. Los Angeles, Oakland, Calif.
Tri-State Culvert Mfg. Co. Memphis, Tenn.
Tri-State Culvert Mfg. Co. Atlanta, Ga.
The Wheat Culvert Co., Inc. Newport, Ky.

# *Flexible* and Permanent

BECAUSE it has flexibility to distribute the heavy pressures of a deep fill, the corrugated culvert is favored over the rigid culvert.

To this constructional advantage Toncan Iron adds the virtue of longer life.

Toncan Iron builds up its well-known resistance to corrosion and erosion by the inclusion of copper and molybdenum. These elements give the naturally resistant iron a still further protection against weathering and corrosion.

For permanence at reasonable cost, install Toncan Iron culverts

*Nearly 150 steam and electric railroads use Toncan Iron Culverts.*

CENTRAL ALLOY STEEL CORPORATION, *Massillon*, OHIO
*World's Largest and Most Highly Specialized Alloy Steel Producers*
*Makers of Agathon Alloy Steels*

Cleveland Detroit Chicago New York St. Louis
Syracuse Philadelphia Los Angeles Tulsa
Cincinnati San Francisco Seattle

TONCAN COPPER MO-LYB-DEN-UM IRON

# *This Derail is the Ultimate in Simplicity and Economy*

*Photograph showing an actual installation of the Q & C Self Adjusting Sliding type Derail.*

THERE are many reasons why the Q & C Self Adjusting Sliding type Derail reaches new heights in simplicity and economy.

*Simplicity:* There is only one model and this covers all the rail sections. It is easily installed with standard track tools and there is no adzing or shimming the ties. The derail blocks and housings are interchangeable, and should one be broken it is only necessary to replace the broken part by another taken from the storehouse. The derail block can be put in without removing the housing.

*Economy:* Only one model is necessary in your storehouse to fit all rail sections. Base plates extend under the rail giving a firm installation, assuring a positive derailment and eliminating the necessity of rail braces and other extra material.

The Q & C Self Adjusting Sliding type Derail is designed for use with standard screw jaw and rod connections in all interlocking and operating stand installations. Standard track tools are used.

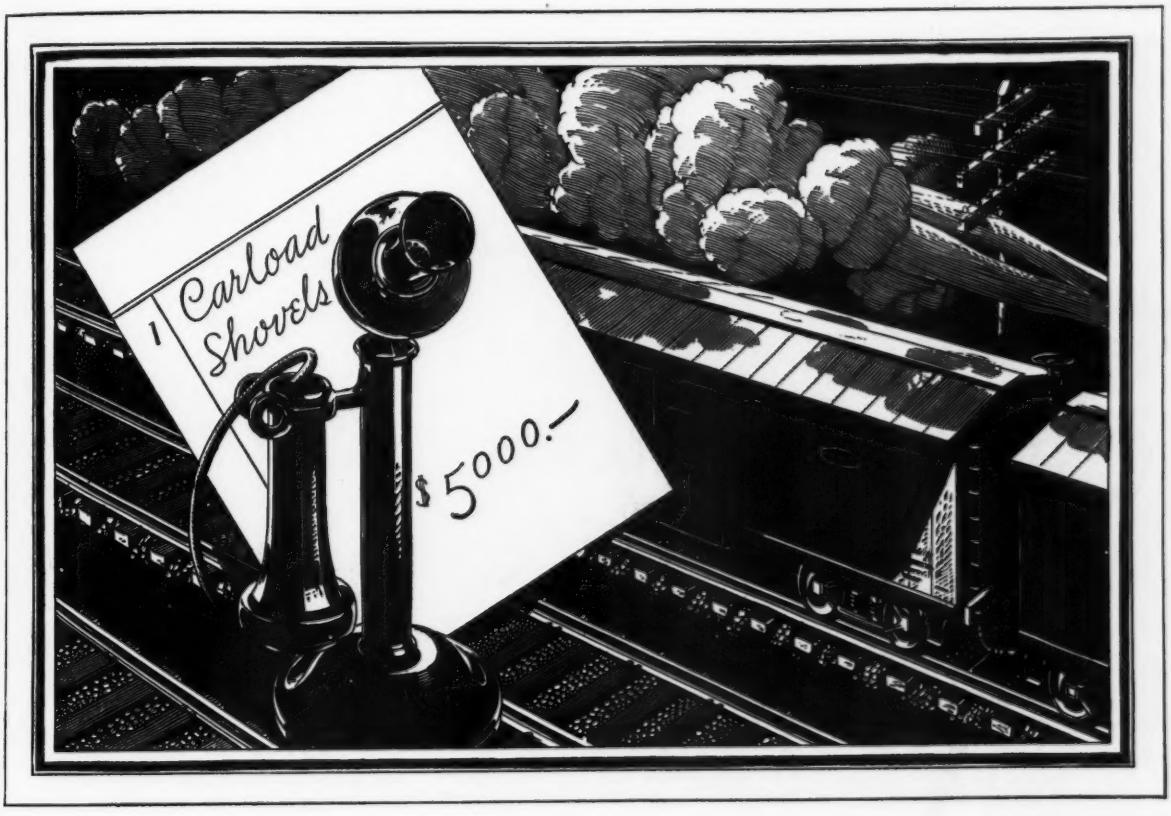
*We will be glad to demonstrate to your satisfaction the simplicity and economy of the Q & C Self Adjusting Sliding type Derail.*

## The Q & C Company, 90 West St., N. Y.

Manufacturers of Track, Car and Engine Devices

ST. LOUIS - - - - People's Gas Building
CHICAGO - - - Railway Exchange Building

# Called on him for 3 years Then, a $5000 order by Telephone




*An Advertisement for Bell Long Distance Telephone Service*

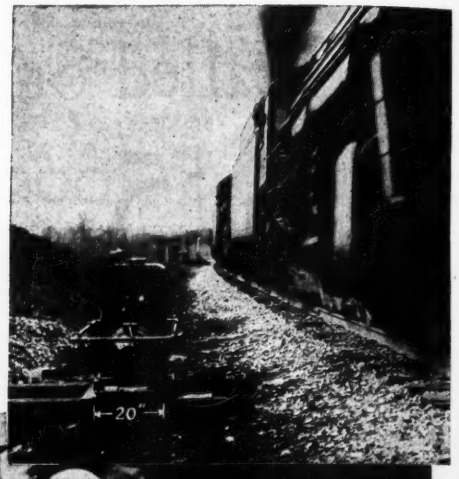
THE sales manager of a West Virginia tool company made personal calls upon a Cincinnati jobber for three years—without making a sale. Then one day he learned that a large job of work was to be started. He instantly called the jobber by Long Distance. Sold him a carload of shovels. Amount of the order, $5000. Telephone charge, $1.30.

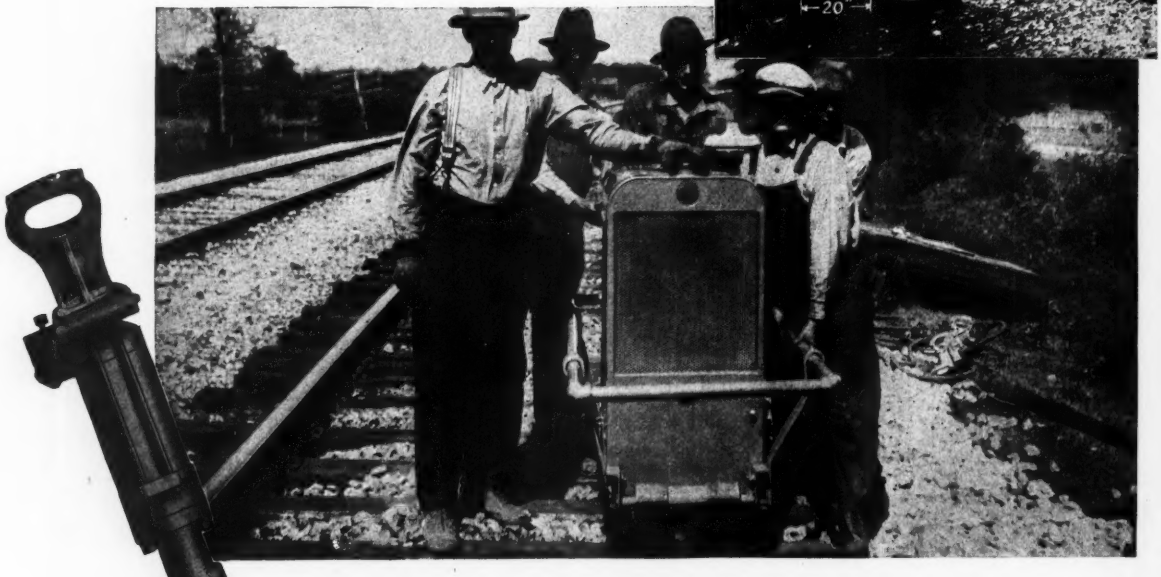
In the packing industry, reams of correspondence are often exchanged before specifications can be agreed upon. In a 10-minute telephone conversation, an Austin, Minnesota, firm took a 5-carload order and laid the groundwork for future shipments of 500,000 pounds. The new customer was 1500 miles away.

A Cedar Rapids insurance man had learned to use Long Distance while in the coal business. Each week from his desk he calls an average of 20 of his salesmen. "It enables me to talk to them just as well as if I visited them in person." In five years, his annual business has increased from one million to five and a half million dollars.

What long distance calls could you profitably make now? They are inexpensive. New station to station day rates are: San Francisco to New York, $9. Pittsburgh to Boston, $2.20. Chicago to Detroit, $1.35. Newark to Philadelphia, 60c. . . . . Calling by number takes less time. . . . . *Number, please?*

# *Easily lifted—*
# *—Quickly moved*



The Syntron Tie Tamper is gearless and motorless. Nothing moves but the piston, and it cannot be stalled or overloaded. It is driven by the Syntron Power Unit instead of a cumbersome compressor. Each tamper easily cradles "in the lap" of the worker, eliminating strain and back-breaking.

The speed and ease with which the Syntron Tie Tamping Outfit can be moved about is one of the reasons why these efficient outfits are of so much practical value to railroads. Five men can easily lift the Syntron Power Unit. Dolly wheels on the bottom enable it to ride on the rail. In ten minutes it is moved a thousand feet. When off the rail, in use or out, the Syntron Power Unit rests on the track shoulder. Only 20 inches wide, weighing only 750 lbs., there is no danger of mishaps and fewer men are required for the job.

Each Syntron Electric Tie Tamper, delivers 1,500 powerful blows a minute, packs the ballast with a vise-like grip, makes a smooth, firm bed that will outlast hand tamped track by two or three times. Four men with a Syntron Outfit will do the work of twelve men with tamping picks.

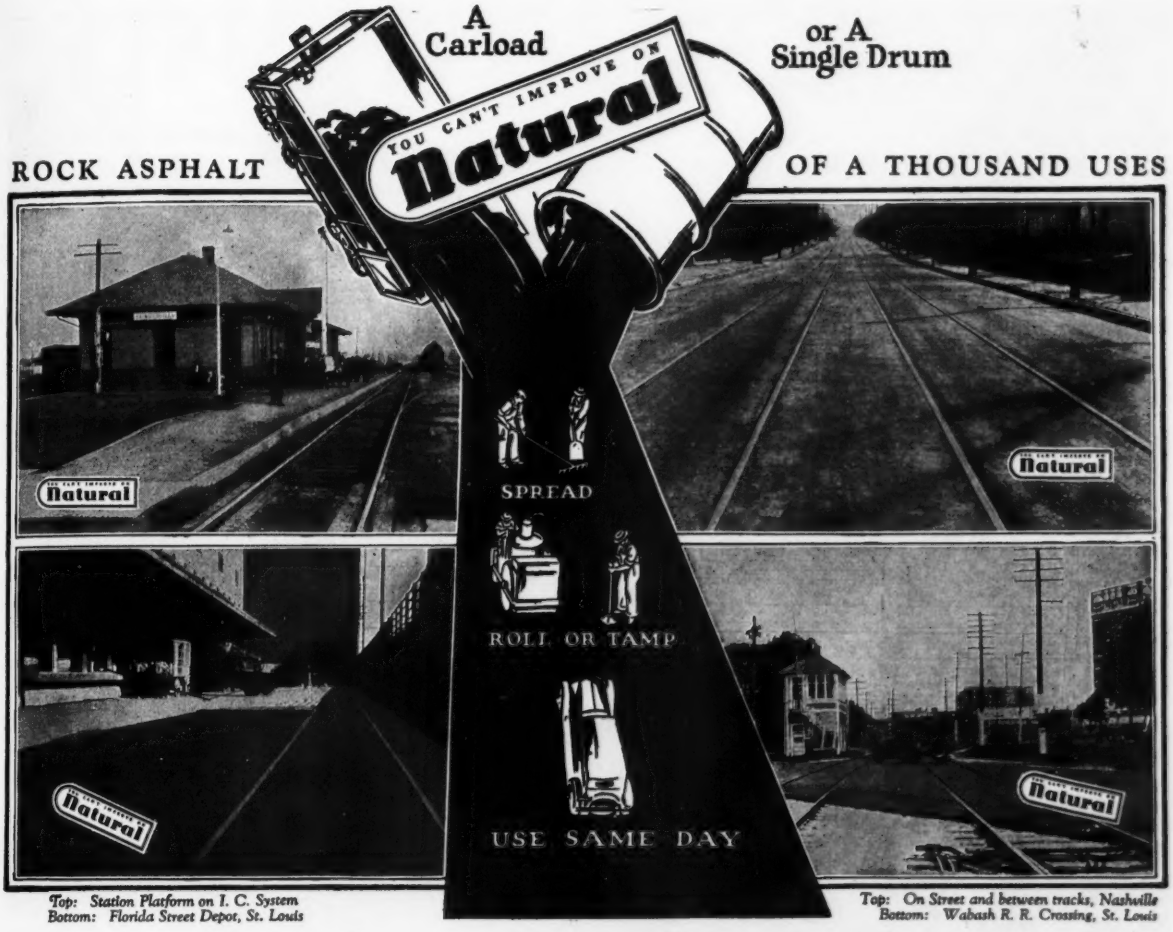
*Write for literature illustrating and describing the complete Syntron Outfit. No obligation whatever. Address*

**SYNTRON COMPANY**
**Lexington Ave. Pittsburgh, Pa.**

# SYNTRON
## *Electric Tie Tampers*

A Carload or A Single Drum

ROCK ASPHALT OF A THOUSAND USES




Top: Station Platform on I. C. System
Bottom: Florida Street Depot, St. Louis

Top: On Street and between tracks, Nashville
Bottom: Wabash R. R. Crossing, St. Louis

# A Complete Surface Material

## *no mixing—no heating—no delay*

AS SOON as Natural Rock Asphalt is received from the plant, it is ready for use. It does not have to be mixed with other materials; it does not even have to be heated. Simply spread it on its base, roll or tamp it, and it is ready for traffic.

Preparation costs do not have to be added to its original cost, as they do to that of most other surfacing materials. No mixing mistakes are possible, because no mixing is required. There are no traffic tie-ups after the material is laid.

You can buy just the quantity of Natural Rock Asphalt that is required for your job—as it is sold in easily unloaded open top cars or in convenient drums. If any of the material is left over, it can be stored indefinitely indoors or out and used when it is needed.

Due to the special characteristics of the Pottsville Rock Asphalt Formations in Edmonson County, Kentucky, from which Natural Rock Asphalt is quarried, surfaces of this material are tough, resilient, non-skid, do not shove or wave and are easy to maintain.

**Non-Skid**
**Easily Stored**
**Long Wearing**
**Resilient**
**Uniform**

**GET THIS BOOK**

Some of the railroad uses of Natural Rock Asphalt are: on crossings, platforms, bridges, between tracks, on warehouse, shop and recreation floors, etc. Its resiliency, durability, non-skid surface, ease of storage, insulative and preservative qualities suit it particularly to these uses.

*Mail this coupon for free book describing Natural Rock Asphalt and its Railroad uses.*

The Prendergast Co., *(Railroad Distributors)*
Marion, Ohio.

Send me free book on Railroad uses of Natural Rock Asphalt.

Name_____

Address_____

NATURAL ROCK ASPHALT CORPORATION, *Incorporated,* LOUISVILLE, KENTUCKY

—no loss

## *Cement Bags* that empty out clean

TODAY, the saving way to use cement or plaster is to get it in Bates Multi-Wall Paper Bags. These modern containers empty out clean. The mixer receives every pound of material just as it left the mill, 100% usable and in perfect condition.

With their 5 separate walls of tough, impervious paper, Bates Bags give reliable protection from rain, atmospheric moisture and rough handling. They eliminate dusting and reduce bag breakage to a minimum. And when they've done their work, they need not be returned for credit.

Buy the cement and plaster for your jobs in Bates Multi-Wall Paper Bags and avoid loss.

BATES VALVE BAG CORPORATION
35 East Wacker Drive, Chicago, Illinois

BATES Multi-Wall PAPER BAGS

Bates Multi-Wall Paper Bags are made by the Bates Valve Bag Corporation in 8 modern plants throughout the country.

# *ADVANTAGES of the Lundie Tie Plate*

**Holds track to rigid gauge under every traffic condition. Plate does not move on the tie.**

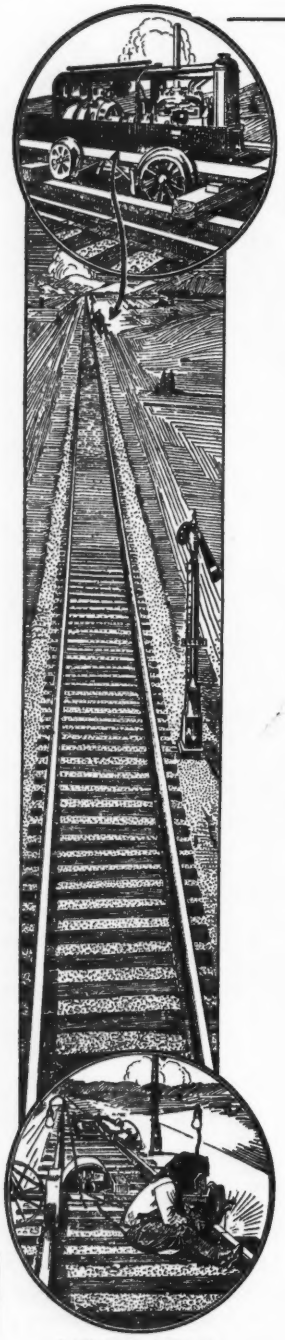
**Insures maximum tie life. There is absolutely no cutting into the ties due to the absence of any destructive ribs.**

**Under traffic the plate seats itself uniformly and develops a hardened glazed wear resisting surface on the tie.**

**Safeguards against mechanical wear, lowers maintenance costs and assures maximum return from your investment in ties and cost of treatment.**

**The Lundie Engineering Corporation**
**285 Madison Avenue, New York**
**166 West Jackson Boulevard, Chicago**

# LUNDIE TIE PLATE



A MILE AT A TIME

# Over 250,000 Battered Rail Ends Renewed

"Under Traffic" by the

## TELEWELD PROCESS

*- - without preheating - -*

## "A MILE AT A TIME"

actually making them **better than new.**

We furnish a complete service with skilled Operators, expert supervision, definite cost and fixed responsibility.

A representative will gladly call and explain this proven method of rail end restoration which extends the life of old rails, and makes track ride better than new.

San Francisco
952 Howard Street

Salt Lake City
Continental Bank Bldg.

**ELECTRIC RAIL WELD SERVICE CORP.**

Denver
2101 Blake Street

Spokane
Old Nat. Bank Bldg

RAILWAY EXCHANGE BUILDING, CHICAGO

Typical picture of rail ends showing low joints

Same rail ends rebuilt by Teleweld

# CARNEGIE RAILS

# & RAIL JOINTS

Control of manufacture from ore mine to finished product, plus unlimited facilities for correct manufacture, permit us to serve you promptly and efficiently. Let us quote on your next requirements.

CARNEGIE STEEL COMPANY
PITTSBURGH, PA.

The TracKrane laying 130 pound rails, 39 feet long. The full revolving feature and long boom are advantageous when loading or unloading rail also when handling and storing other materials.

# The New Nordberg TracKrane

## *Full revolving—Safety hoist*

For smoothness of control and easy handling, the Nordberg TracKrane has no equal. It cannot be classed with the ordinary rail crane. It has all the features of larger machines, yet its speedy operation makes it especially suitable for rail laying work.

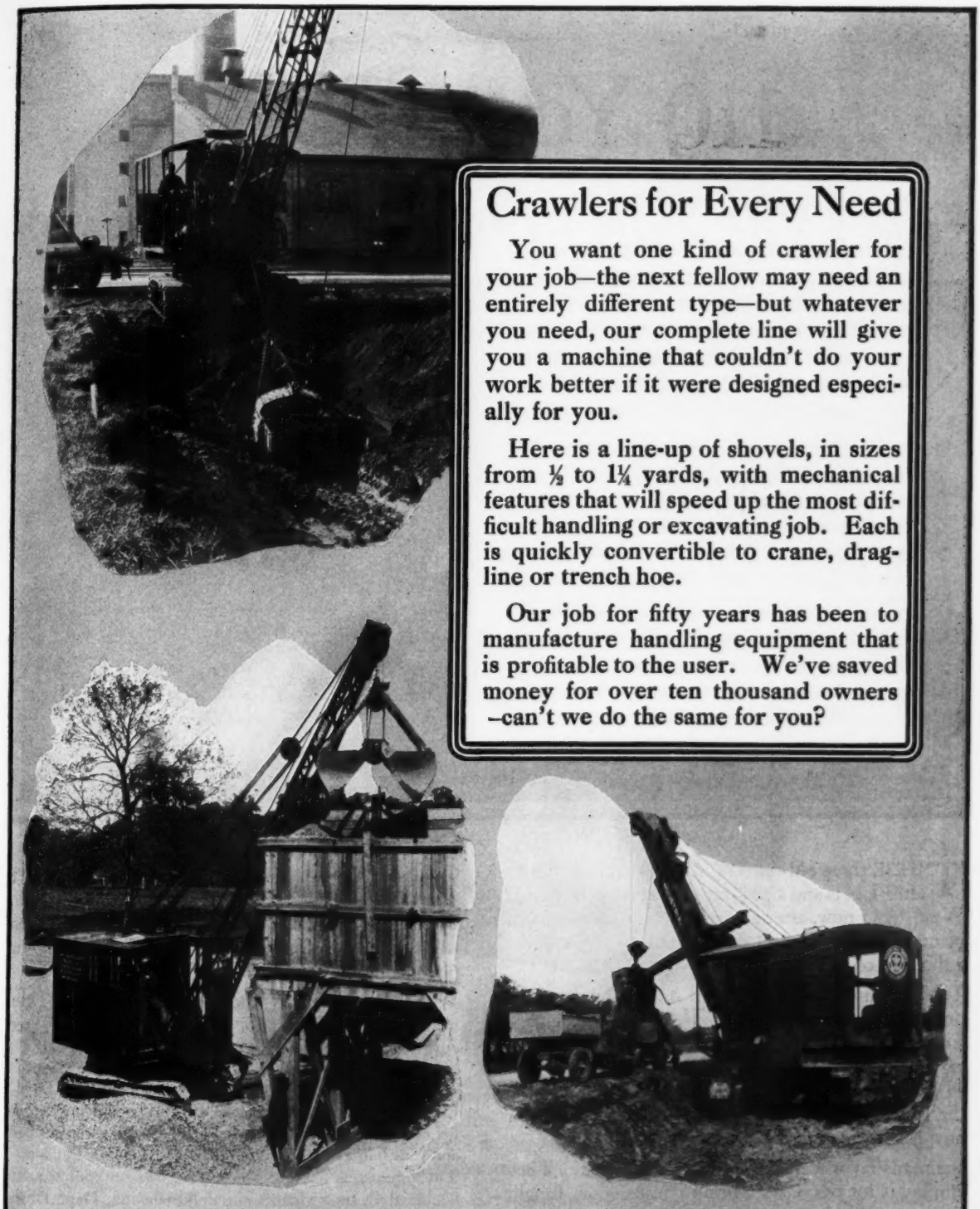
The load must be lowered under power and cannot be dropped by carelessness or faulty handling. All movements are secured through friction disc clutches which are disengaged when the operator removes foot from the respective pedal. Those seeking a machine that will assure speed and safety will find the answer in the new Nordberg TracKrane.

Another time and labor saving Nordberg product is the Track Machine. Wherever track must be raised or shifted on elevation work, yard construction, etc., it will reduce the track gang at least by half.

**For further particulars about these unusual machines write for Bulletins YE-11 and 8**

## Nordberg Mfg. Co., Milwaukee, Wis.

# NORDBERG



## Crawlers for Every Need

You want one kind of crawler for your job—the next fellow may need an entirely different type—but whatever you need, our complete line will give you a machine that couldn't do your work better if it were designed especially for you.

Here is a line-up of shovels, in sizes from ½ to 1¼ yards, with mechanical features that will speed up the most difficult handling or excavating job. Each is quickly convertible to crane, dragline or trench hoe.

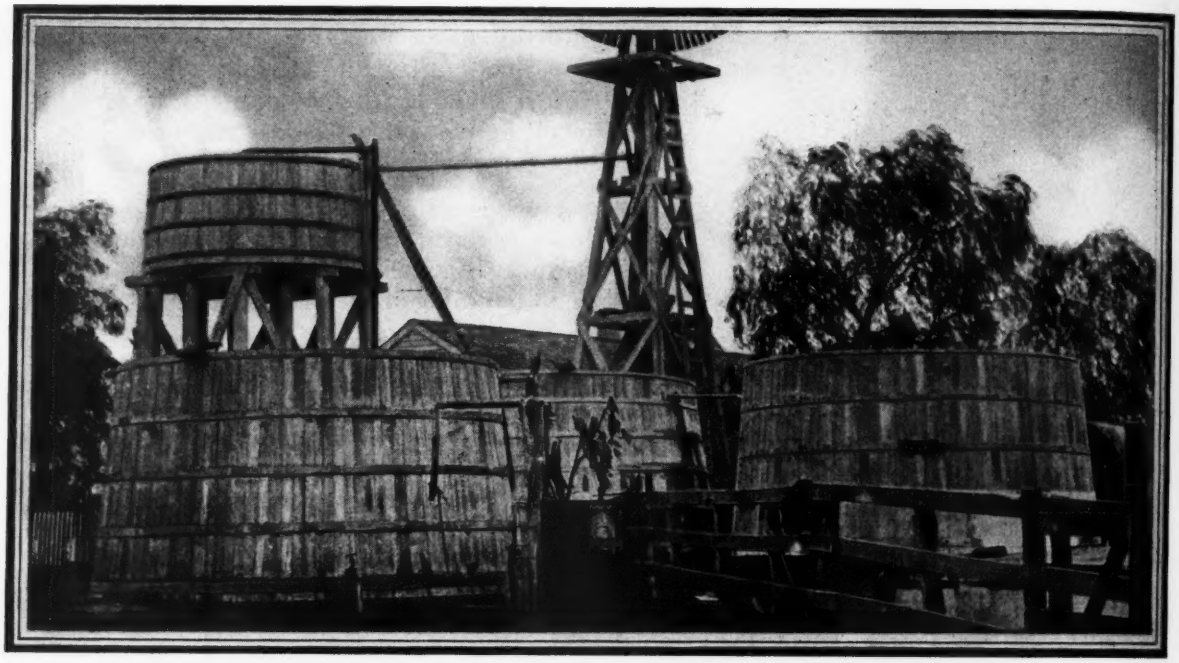
Our job for fifty years has been to manufacture handling equipment that is profitable to the user. We've saved money for over ten thousand owners —can't we do the same for you?

Industrial Brownhoist Corporation
General Offices: Cleveland, Ohio.
District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, St. Louis, San Francisco, New Orleans, Bay City, Mich.

INDUSTRIAL BROWNHOIST

# 110 Years Old

## *—they still smile at moisture and the sun*



THESE three old-timers set out in service shortly after Lewis and Clark set out for the unexplored West. And now, after a hardy career on a Southern plantation, they are still on active duty—with never a thought of retirement.

Their striking testimony is only one of the thousand proofs of the durability of Tidewater Red Cypress. For this lumber is used the world over in shipbuilding. Millions of feet of it are used in industry. Hundreds of Colonial houses now standing reveal the fact that America is still too young to know how long a cypress structure can endure.

Railroads favor it more and more each year. They employ it for passenger station construction, freight sheds, warehouses, platforms, conduits, water tanks, cars, fencing, and every other place where upkeep must be cut down.

For economy in your business, use this Wood Eternal. Its first cost is your last cost. It knows no replacement, or repair bills.

When you order this wood, be sure to specify Tidewater Red Cypress, for only "coastal type" red cypress has these qualities of durability.

***"Money Saved for Builders"—sent free***

Complete data on Tidewater Red Cypress, and suggestions for cutting down the operating expenses of your business and your home, await you in "Money Saved for Builders." This interesting booklet will be sent free on your request. Southern Cypress Manufacturers Association, Dept. RF-6, Barnett Building, Jacksonville, Florida.

*Specify* TIDEWATER RED CYPRESS

THE WOOD ETERNAL

*Above—New station of the Southern Pacific Railway, Redlands Calif.*

*At left—Concrete train shed, Southern Pacific Railway, Sacramento, Calif.*

# *For Modern Railway Structures*

MANY of America's progressive railroads, among them the Southern Pacific Railway Company, are finding in portland cement concrete the ideal building material for stations, train sheds, signal towers, bridges and other structures which are duplicated at various locations.

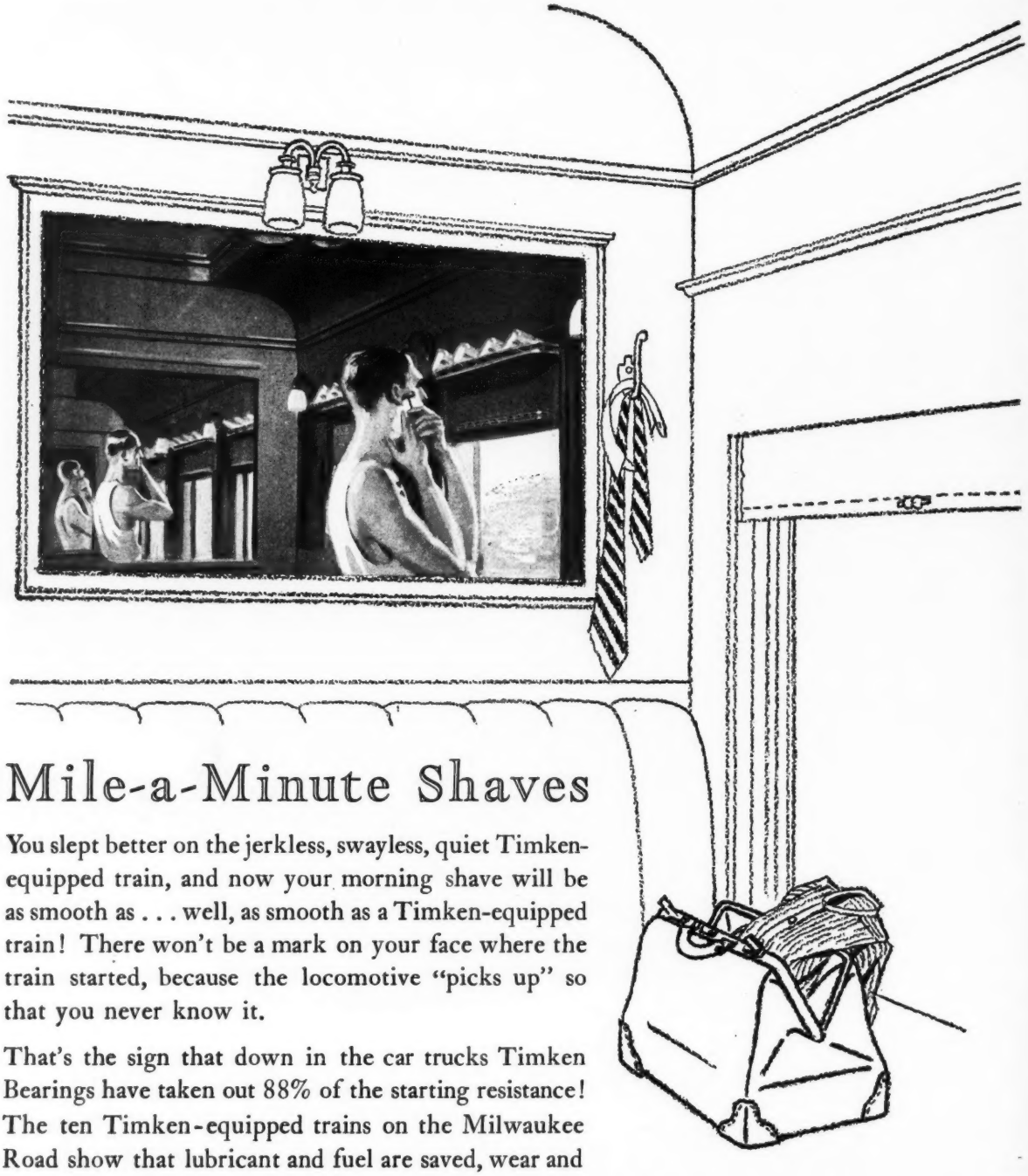
Precast concrete units, which are extensively used in such installations, are manufactured according to factory principles of production and quality control, thus combining economy of cost with full flexibility of arrangement and size.

Rail structures of portland cement concrete are firesafe, and successfully withstand the attacks of climate and constant use.

## PORTLAND CEMENT *Association*

*Concrete for Permanence*

CHICAGO



# Mile-a-Minute Shaves

You slept better on the jerkless, swayless, quiet Timken-equipped train, and now your morning shave will be as smooth as . . . well, as smooth as a Timken-equipped train! There won't be a mark on your face where the train started, because the locomotive "picks up" so that you never know it.

That's the sign that down in the car trucks Timken Bearings have taken out 88% of the starting resistance! The ten Timken-equipped trains on the Milwaukee Road show that lubricant and fuel are saved, wear and tear prevented, maintenance costs greatly reduced, and hot boxes banished.

Timkens are *more than anti-friction bearings.* They have the full thrust capacity, the greater load-carrying area, the shock-resistance—the endless durability—for *railroad* anti-friction bearings.

**TIMKEN**
***Tapered***
**ROLLER BEARINGS**

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

ONLY TIMKEN BEARINGS COMBINE TIMKEN TAPERED CONSTRUCTION, TIMKEN-MADE ELECTRIC STEEL, AND TIMKEN *POSITIVELY ALIGNED ROLLS.* THAT IS WHY TIMKENS COMBINE LOW ROLLING RESISTANCE WITH UTMOST WEAR RESISTANCE.

*A Partial List of Railroads using Universal Pipe*

PENNSYLVANIA LINES
FLORIDA EAST COAST
NEW YORK, NEW HAVEN & HARTFORD
CHICAGO, BURLINGTON AND QUINCY
LONG ISLAND
DELAWARE, LACKAWANNA & WESTERN
MOBILE & OHIO
CANADIAN PACIFIC RAILWAY
BOSTON & ALBANY
BOSTON & MAINE
CENTRAL VERMONT
CHICAGO AND NORTHWESTERN
LOUISVILLE & NASHVILLE
WHEELING & LAKE ERIE
INTERNATIONAL RAILWAYS OF CENTRAL AMERICA
TRUXILLO R. R. OF HONDURAS
TELA R. R. OF HONDURAS

# Dependable water supply . . . Experienced labor unnecessary

Wrenches are the only tools needed to lay Universal Pipe. Lead, lead-substitutes and all other jointing materials are eliminated. No pouring, no calking, no bell holes to dig.

Nothing to deteriorate, nothing to blow out, nothing to work loose in these tight, flexible, dependable joints.

The contact surfaces of the hub and spigot ends are machined on a slight differential taper making a natural iron-to-iron joint that amply provides for expansion and contraction, vibration and uneven ground settlement.

Approved by the Underwriters Laboratories which are under the direction of the National Board of Fire Underwriters.

Valves and hydrants of the best known makes are obtainable with the Universal Pipe machined joint.

For water supply, fire protection and other service where freedom from leakage is essential. Easier! Quicker! Safer! Address nearest office.

**UNIVERSAL CAST IRON PIPE**

No bell holes to dig: No joints to calk

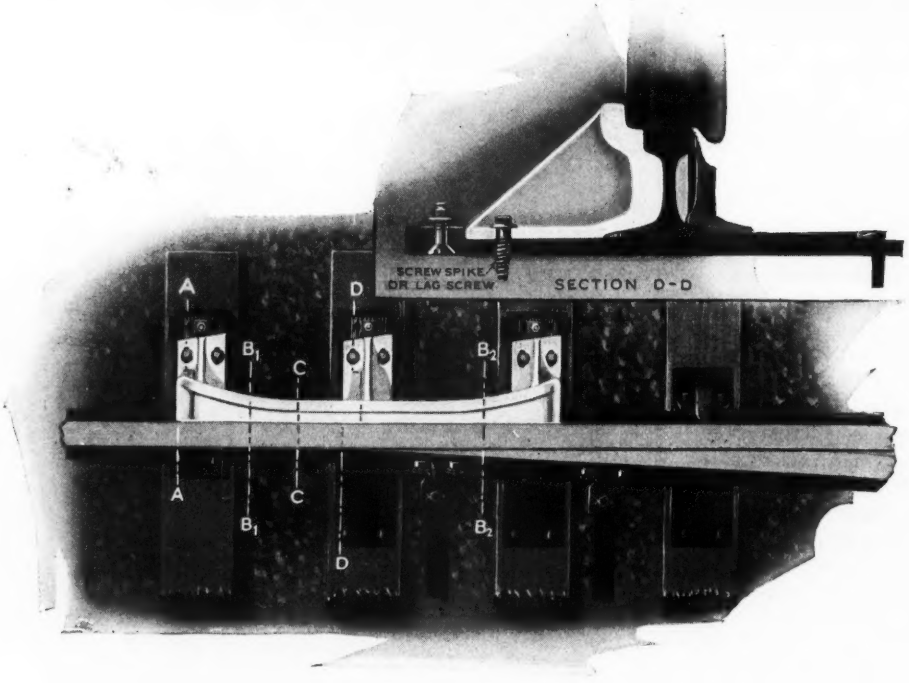
THE CENTRAL FOUNDRY COMPANY

*Subsidiary of* The Universal Pipe and Radiator Company

Graybar Building, 420 Lexington Avenue

Chicago Birmingham New York Dallas San Francisco

R-5




# Reduce The Wear On Your Switch Points

THE Racor manganese flange switch guard affords absolute protection of switch points.

The flange has a long easy flare like the flare of standard solid manganese self-guarded frogs, so that wheels engaging it run with equal clearance from either rail. This prevents them from crowding against the protected point and also from being crowded against the opposite rail.

The cast manganese steel guard is held rigidly in place by braces integral with it, which back upon the shoulders on the ends of the three special plates either directly or against adjustable wedges, illustrated, as may be preferred. Thus the stock rail is braced solidly against the risers on the plates, preventing any lost motion.

The Racor guard will stay put for long service without maintenance and is, therefore, economical.

RACOR manganese flange switch guards can be used with any standard switch. They are of substantial design and rigid construction, with an unexcelled record of durability and dependable performance. In common with all RACOR products they are—

*"Built for Service"*

## RAMAPO AJAX CORPORATION

*Main Office*—HILLBURN, NEW YORK
SALES OFFICES AT WORKS, ALSO
30 CHURCH STREET, NEW YORK
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*Eight Works*—
Hillburn, N.Y. Niagara Falls, N.Y. Chicago, Illinois, East St. Louis, Ill.
Pueblo, Colorado, Superior, Wis. Los Angeles, Cal. Niagara Falls, Ont.

# Railway Engineering and Maintenance

Volume 24 June, 1928 Number 6


## Concentration Produces Results

NO SINGLE practice interferes as seriously with the efficiency of a gang as the constant changing from one task to another. In the work of section gangs, particularly, this must be guarded against, for much of the work of such forces consists of small tasks; yet even here it is possible for a foreman so to arrange and group these tasks as to give them a semblance of order. If these tasks are grouped in a logical manner and the program kept before each man in a gang, lost motion will be reduced greatly and the completion of such tasks expedited.

No single attribute affords a better indication of the efficiency of a foreman than the ability which he displays in developing a program and in the manner in which he sticks to a task until it is completed. If the work in hand is the renewal of ties, the efficient foreman will begin this operation at one end of his section and stay with it until it is completed; then he will undertake the next task. In this way he will avoid the tendency to "putter" and will be able to show constructive results for each day's work.

Systematic planning and constant follow-up of work are essential to the success of every foreman. They deserve to be made part of the training of every man prior to his appointment to such a position.

## Do You Permit Carelessness?

THE TASK of keeping the subject of safety constantly before railway employees is not an easy one. Yet for the very reason that safety agents and the supervisory forces generally have succeeded in doing this, the railways as a whole have attained as remarkable a record in saving lives as they have in saving labor. But just as there have been marked variations in the degree of success attained by different roads in saving labor, so also are there wide differences in the accident records. The reasons for these differences are not hard to understand if one stops to consider how often he observes violations of what have come to be considered common-sense rules of safety.

It is agreed that men should not stand on any main or running track when a train is passing on an adjoining track; yet this rule is not always enforced. It is just as essential to avoid the use of chisels with ragged heads; but they continue in use. These things happen because the man in direct charge of the gang has not had the importance of safety impressed on him to an extent that makes it second nature for him to think of it.

It is easy to fall into the habit of thinking of the safety officer as a sort of tiresome pest who is always harping on the same subjects over and over, but unless he or someone else keeps safety constantly before the men they will forget. The roads which have accident prevention most efficiently organized have the best accident records. The supervisory officer or foreman who gives the most attention to safety will, in the end, have a better record than his neighbor who permits or overlooks carelessness on the part of his men.

## Can You Point to Your Successor?

IF THE general manager of your road should ask you to recommend a man for promotion, possibly your own successor, are you in a position to do so? This question was raised at the last meeting of the International Track Supervisors' Club at Buffalo on May 17, and while it was addressed to track supervisors in particular, it has application all of the way along the line. The question was not intended to mean merely whether one could name a man, but rather whether he could recommend one whom he was willing to vouch for and stand behind. In other words, is one developing certain men under him with the specific idea of building up the future supervisory forces of his road? When the time comes, can he point to a man and say that he can fill the bill? Such recommendations are asked frequently on every road, and the foreman, supervisor or higher officer who cannot point conscientiously to a man and be willing to stand behind his recommendation is falling down on his job in one respect at least. He owes it to himself; he owes it to the man under him who is capable and shows qualifications of leadership; and he owes it to the railroad to encourage and to develop the capacity of the more promising men under him in order to help maintain a high class of supervisory forces. Such were some of the thoughts expressed at the meeting, which are worthy of careful attention, not only by track supervisors but by all railway men in supervisory capacities.

## Better Maintenance Makes Faster Schedules Possible

DURING the last month three of the railways operating between Chicago and St. Paul-Minneapolis shortened the schedules of their fastest trains one hour and twenty minutes. On the same date the roads operating between Chicago and the North Pacific Coast cut their schedules two hours. Since our last issue the Pennsylvania and the New York Central have each cut the time of two of their fast trains between Chicago and New York to 21 hours, only one hour slower than their Broadway and Twentieth Century limited trains. On the Pacific Coast the Southern Pacific has reduced the running time of its fastest train between San Francisco and Portland one hour. These changes are typical

of many that have been made of late in service between the more important cities—changes so numerous that there are few important centers that have not been drawn closer together in this way within recent weeks or months.

The improvement in passenger service, while most striking, is no greater than that which has taken place in freight service. Schedules have been shortened over the country, with the result that much freight is now handled on schedules approaching those of passenger trains. Even more important, these schedules are being maintained with passenger-train regularity.

This achievement is of direct interest to maintenance of way men, for it has been made possible largely by their efforts. In no previous period of history has as great an improvement been made in tracks and structures as during the last five years. As a result the roadway is in better condition today than ever before. This makes possible the operation of trains at the higher speeds with the same and even a greater degree of safety than prevailed a few years ago.

Such a development constitutes a public service of the highest order. It is an achievement in which maintenance men may take pardonable pride. At the same time these high speeds place a greater responsibility on maintenance men, for they are more exacting in their requirements and the results of neglect or omission are more serious. Having made a good start, it is incumbent on maintenance men to maintain the pace they have started.

## What Use Do You Make of It?

MORE than 10,000 copies of *Railway Engineering and Maintenance* go every month to supervisory officers and others interested in the maintenance of tracks and structures in the United States, Canada and other countries throughout the world. The editorial and advertising pages of this publication are devoted to the presentation of the latest and most efficient methods, materials and equipment employed in this branch of railway service with the object of aiding the man in direct charge of work in the field in improving his practices and reducing his costs.

Information is constantly coming to our attention of the benefits that readers are realizing through the application of ideas brought to their attention through this publication. In many instances, we have been told of articles being copied and given wide distribution on individual roads. We have also been advised by a number of supervisory officers that it is their practice to use the paper as a text book in meetings of their foremen, selecting certain articles pertaining to the work in hand for discussion at such meetings.

Naturally, we are pleased at these evidences of recognition of the practical value of the information we have selected as worthy of publication. We are even more pleased, however, with the fact that by these means the railways, to whose efficient maintenance we are devoting our energies, are profiting by the application of these ideas.

In the hope that this influence may be extended still further, we venture to solicit the co-operation of our readers in writing us of their experience in the use of *Railway Engineering and Maintenance* and of ways which they have found to extend its influence and helpfulness. If you have found certain articles helpful we urge you to tell us of them. If you have used the paper in any way that has extended its influence, write us. In making this request we are not looking for "bouquets" or compliments, but for your ideas and your experiences, with the thought that they may be suggestive and helpful to other railway men in securing the more intensive use of their copies of this publication. You will thus contribute to the common betterment of maintenance practices just as directly as if you sent us a "short cut" for the performance of some task. If the influence of your copy of *Railway Engineering and Maintenance* extends beyond your desk, write us today how this is accomplished, while the idea is fresh in your mind. We thank you in behalf of other railway men who will profit from your experience.

## Highway Crossings

HIGHWAY traffic has attained a speed, weight and density that was undreamed of twenty years ago and with this change have been imposed almost insurmountable problems for those whose duty it is to provide pavements that will endure throughout the life of the bond issues with which they have been financed. That they have been none too successful should be apparent to almost anyone. Who has not witnessed the rapid destruction of expensive pavements on heavily traveled streets and roads?

It would be well for one to give due consideration to these facts before he undertakes a study of highway crossings of railway tracks, for, regardless of the many conditions which any type of crossing construction must meet to insure its success, the requirement that it provide a durable roadway surface comes first. If it does not meet this condition, its successful fulfillment of the other requirements is of no consequence.

This statement must be interpreted in terms of the difference between the conditions imposed on the crossing and those on the highway away from the track. For example, as pointed out by F. W. Hillman in the article appearing on page 253, there is no economy in providing a pavement that will last longer than the interval of time that the crossing can be left in place before it must be removed for track repairs or renewals, unless it is of a type that can be removed and replaced. However, the current tendency in crossing construction practice is to extend this time just as far as possible by insuring adequate drainage, providing a deep bed of good ballast, eliminating rail joints within the limits of the crossing, etc.

While the selection of a paving material that will stand up under highway traffic is the primary requirement for success, it is by no means the only one. A pavement built over a track is subjected to one condition that does not obtain at points remote from the track and which introduces a serious difficulty. The rails of all tracks are subjected to vertical movement under the wave action that takes place with the passing of trains. The extent of this movement varies with the physical condition of the track structure but it must be reckoned with in even the most substantial construction. To be a success any type of crossing construction must make provision for movement of the rails relative to the pavement as well as movement of the pavement supported by the ties relative to the pavement beyond the ends of the ties.

In view of all these complications it is not surprising that some efforts at highway crossing construction have met with failure or indifferent success. It should be clear also that the requirements for good results will become more exacting as highway traffic increases and as the highway-using public becomes accustomed to smoother riding pavements. And just as public highway officers have come to understand that serviceable

pavements for heavy traffic cost considerable money, so the railroads must realize that a substantial highway crossing can be had only by making a sufficient expenditure.

## A Loss That Challenges Attention

IN SPITE of the fact that the amounts charged to maintenance of way accounts for cross ties are more than twice as large as those for rails, most officers in charge of track maintenance give far less attention to the selection and purchase of ties than of rails. This may be due in part to the more direct relation of the quality of rails to accidents. It is due even more, however, to their failure to realize the magnitude of the losses that result from the present wide-spread, haphazard purchase and inspection of ties. In fact maintenance officers on many roads give so little attention to the character of the ties furnished them, an attitude which is in such marked contrast to the care with which they study other expenditures and ways to reduce them, as to make explanation difficult.

The losses due to the present lax methods of selecting ties are evident in numerous ways. One needs only to study the tie renewal records on roads of similar traffic and climatic characteristics and with records of treatment for similar periods, to see how widely the results vary. In numerous instances the renewals vary as much as 50 ties per year per mile of track maintained. Such discrepancies call for study to determine the causes. Yet such records are attracting relatively little interest on many roads which are in a position to profit most largely.

It is greatly to the credit of the railways that they have so generally recognized the economy of treatment of their ties. Yet treatment alone will not insure increased tie life. An inspection of a considerable number of ties taken out of the main track of well maintained railway within the last month showed numerous creosoted ties carrying dating nails of 1917 and even more recent years, revealing a life far short of what might reasonably be expected. When such results are secured on roads of generally high maintenance standards they afford cause for concern. The difficulty may lie with the treatment. More generally, however, it goes back of the treatment to the material treated.

Neither is the trouble confined to the past. Rather, it is wide-spread today. It is true that some roads have made a marked improvement in recent years, but it requires only a superficial investigation to demonstrate that serious deficiencies in tie selection and tie-handling practices still exist on many roads. Most prominent among those deficiencies is the indifference towards decay, which is leading to the acceptance of millions of ties today in which decay is well advanced. This attitude is prompted by the fallacious belief that "it doesn't count" and that treatment will overcome the decay. The logical outcome of such an attitude is reflected by the recent observation of the breaking of more than a half dozen treated ties during the unloading of a single car, following their receipt from the treating plant preliminary to their insertion in the track. Such a condition reflects a waste of treatment as well as money paid for the timber itself.

Another serious waste results from the attempt to season ties along the right-of-way, with the object of saving a few cents in the cost of re-handling them for storage in a properly prepared seasoning yard. Many ties that are well manufactured are being exposed to and infected by decay in this way, resulting in a reduction in their ultimate life far greater than the amount saved in re-handling. Likewise laxity of grading is condoned, if not actually encouraged, in order to secure lower unit prices from the producers, which saving is again more fancied than real, because of the fact that the lower price brings out a tie of poorer quality and shorter life.

There is nothing mysterious about tie values. To secure a good tie a road must be willing to pay a fair price. Any other practice is penny-wise. Tie values are subject to mathematical analysis. The loss in tie life resulting from the acceptance of decay, from exposure under unfavorable seasoning conditions, etc., can be approximated with reasonable accuracy. The fact that those conditions which affect and reduce tie life are not being studied more fully by maintenance officers and are not being reflected more generally in their specifications, constitutes a reflection on the care with which they are scrutinizing their largest single expenditure for materials.

It is true that under the organization prevailing on most roads ties are bought and inspected by the purchasing department. In this activity, however, it acts as the agent of the maintenance of way department and will not long take ties that are not acceptable to the using department. Therefore, the responsibility for these conditions rests on the maintenance of way officer, and they will not be corrected until maintenance of way officers correct them. When this time comes other roads will show the same life of ties that is already being attained by the Santa Fe, the Lackawanna and a few other roads. When this day comes maintenance officers will also find that their maintenance of way expenditures have been reduced by many millions of dollars.

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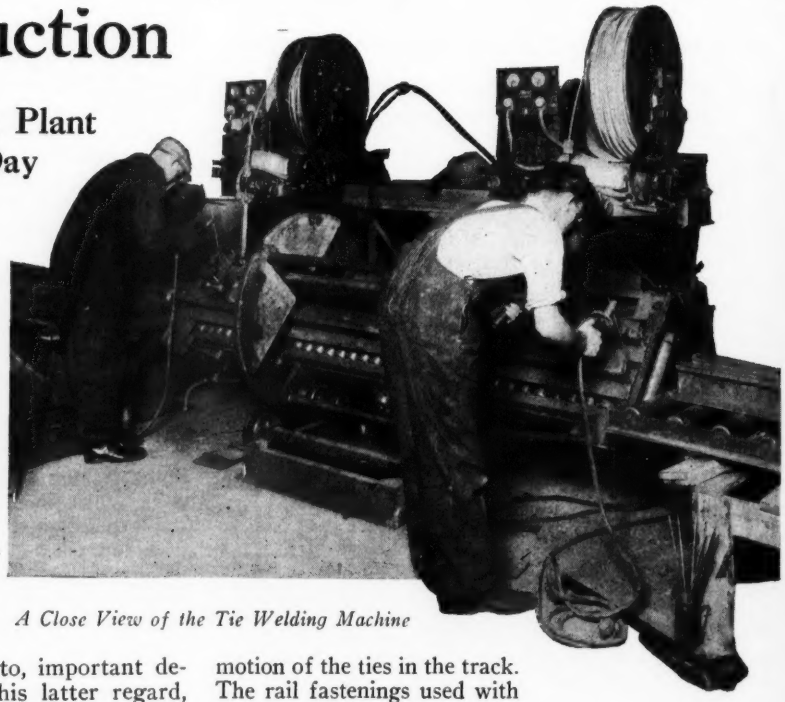
# New Books

**Marine Borers and Their Relation to Marine Construction on the Pacific Coast.** By C. L. Hill and C. A. Cofoid, editors-in-chief. 357 pages. 7 in. by 10½ in., illustrated. Published by the University of California Press, Berkeley, Cal. Price, paper $4, cloth $5. Carriage extra, weight 3 lb.

In 1920 following a period of extraordinary activity of marine borers in San Francisco bay, which resulted in the destruction of a great deal of valuable dock property, an organization was formed to make an exhaustive study of the entire subject of marine borers. This was given the name of San Francisco Bay Marine Piling Committee, but its investigations were national in scope and embraced not only the service records of piling subjected to various preservative treatments and the development of a much more complete knowledge of the biology of marine life responsible for the destruction of wood, but also experimental work with new preservatives and various forms of protective coverings for wooden piles as well as a critical investigation of the behavior of concrete in sea water. The results of this work were published from time to time in progress reports, but have now been presented fully in book form. The primary conclusion is that creosote treatment properly carried out is the most effective protection for wood immersed in infested water and that well-constructed concrete piles or cylinders promise longer life than other forms of construction, but at a considerable increase in cost. These conclusions are supplemented by recommended specifications for creosoting Douglas fir piling for use in sea water and specifications for concrete for new construction. The most interesting feature of the report is the enormous amount of new facts it contains concerning the nature and life habits of teredo, limnoria and other wood boring organisms.

# D. & H. Goes Into Scrap Rail Cross Tie Production

## A Special Fabricating Plant Turns Out 70 Ties Per Day at Cost of $3.96 Each



*A Close View of the Tie Welding Machine*

TWELVE months ago, in the June, 1927, issue of *Railway Engineering and Maintenance,* there appeared a description of a new substitute tie, fabricated from scrap rails, angle bars and tie plates by arc welding, which was being tried out on the Delaware & Hudson with some degree of optimism. Test of the ties on certain tracks had been so satisfactory that the D. & H. was willing to extend their use, but the outstanding drawback was the problem of their economical production. Since the publication of the article referred to, important developments have taken place in this latter regard, and the D. & H. is now manufacturing these ties on an economical production basis, with a broadening program for their utilization already in effect.

In bringing this situation about, the D. & H. installed a complete tie-fabricating plant with specially designed automatic arc welding equipment, which is now turning out about 70 ties a day, or about 21,560 ties a year. To date it has fabricated about 5,500 such ties and is installing them in other than main and branch line tracks as fast as is possible. Through the special equipment installed, the fabrication of these ties has been entirely satisfactory, and the cost of fabrication has been reduced so materially that the D. & H. is convinced that these ties will prove safe, durable and economical.

### Ties Are of Simple Design

Briefly, the ties in question are fabricated from worn-out standard T-section rails, worn angle bars, and new tie plates. Two eight-foot lengths of scrap rail, placed upright side by side, constitute the main body of the tie. These sections of rail are held together by two tie plates, placed across the heads of the tie rails with the proper spacing to form the running rail seats, and welded electrically along both sides to the heads of the tie rails. The tie plates used are the standard design of the D. & H., with a flat bottom, an outside shoulder, and a top cant of 1 in 40. These plates differ from the standard plates only in that spike holes are omitted, and two special punchings are provided to admit the special fastenings used to hold the rail. Supplementing the tie plate welds for joining the tie rails, scrap angle bars are tack-welded across the ends of the tie rails, with the lower leg of the bars extending beneath the rail bases. These bars not only give greater strength to the ties as a whole but act as spacers for the ties and provide an effective means of preventing lateral motion of the ties in the track. The rail fastenings used with the ties consist of comparatively simple rail clamps made from rolled shapes sheared to length, which are held in place by broad-faced spring-steel keys.

### Extensive Use of Ties Is Planned

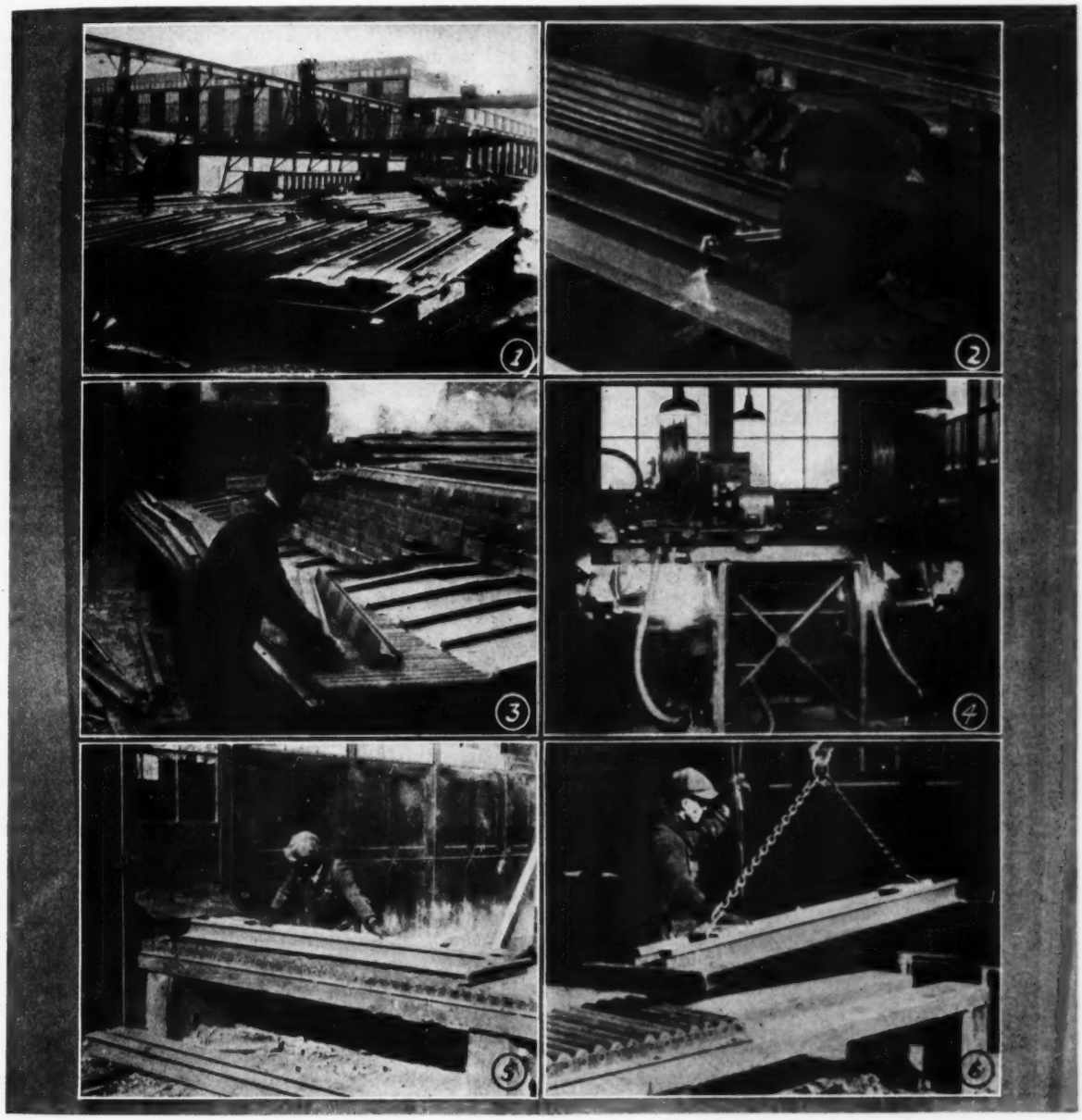
Scrap rail ties of this design were first installed on an important yard running track of the D. & H. at Carbondale, Pa., and the ties of this installation have now been in service for practically two years under an unusually severe test owing to the heavy tonnage and the character of the power passing over them. Since the first installation the D. & H. has made many others and the results obtained have been entirely satisfactory. One of the most effective uses of these ties has been at points in yards and terminals, and in some instances out on the line, where locomotive firemen are in the habit of cleaning their fires directly on the track. Such points have been a continual source of expense to the maintenance department, not only through the necessity of maintaining ash handlers to remove the ashes promptly but more particularly because of the rapid destruction of the timber ties by the hot ashes. In spite of protection for the ties, including the use of a layer of sand, and boiler plate in some instances, the trouble persisted, and it was not uncommon for ties at these points to be completely destroyed between the rails within six months to a year. The seriousness of this destruction is augmented by the fact that all of the timber ties now being used on the D. & H. are treated, adding to the loss incurred. On the other hand it has been observed that the creosoted ties have a greater resistance to fire than untreated ties under such conditions.

It is at such points that the D. & H. first concentrated the use of its scrap rail ties, and has found them most satisfactory for this class of service. All

of these points have now been supplied and the road is extending the use of the ties to all yard and terminal tracks.

### Efficient Layout Facilitates Production

Following its decision to extend the use of scrap rail ties, the D. & H. purchased an automatic arc welding machine from the General Electric Company, which was developed especially for the fabrication of these ties. This machine was installed in the shops of the D. & H. at Colonie, N. Y., and was supplemented by all of the necessary facilities to secure the maximum economy in production. In general the new facilities include a receiving rack and platform where the scrap rails are lined up and cut into eight-foot lengths, a roller conveyor which carries the eight-foot rails in pairs directly to the welding machine, a new steel building housing the welding equipment, a roller conveyor which carries the completed ties away from the welding machine, and a 1,000-lb. capacity electric hoist which loads the ties directly into standing cars. As laid out, these facilities are arranged compactly at the east end of the stores department scrap dock at Colonie, and so located are served by the 10-ton overhead electric traveling crane which regularly serves the dock with either a hook or lifting magnet.



**Various Operations at the Tie Fabricating Plant**

(1) Placing the scrap rails on rail rack with the scrap dock magnet. (2) Cutting the rails into eight-foot lengths. (3) Rolling the short-length rails to the welding machine. (4) The automatic welding machine in operation. (5) Rolling a completed tie from the house. (6) Loading a finished tie into a standing car.

The receiving rail rack at the plant consists of a series of T-section rails spaced about two feet apart and supported a few feet from the ground on heavy timber framework. On this rack, which is of sufficient size to accommodate a large number of 33-ft.

rails, the rails are placed by the scrap dock magnet. In order to facilitate the handling of the scrap rails over the rack, the plane of the heads of the rack rails is slightly inclined, and the space between the rails is closed with either planks or boiler plate so as to permit safe and easy walking over the rack. At the lower end of the rack short sections of rail have been welded to the main rack rails and inclined downward at a greater pitch so as to further reduce the force necessary for sliding the rails.

Cutting of the rails is done on the rack by an oxy-acetylene torch, the points of cuts being indicated accurately by metal guide strips fastened to the platform of the rack at eight-foot intervals. When the rail has been cut to length, the eight-foot sections are pulled down the rack and on to the roller conveyor by means of a two-arm rail tong. On the conveyor, the rollers of which are equipped with ball bearings, the rails are pushed in pairs to the welding apparatus, passing through a small opening in the side of the welding house, which is equipped with a top-hung flap door.

### Special Welding Machine Is the First of Its Kind

The welding apparatus employed at the plant consists essentially of a special tie-welding machine with two automatic welding heads, and a 1,500-amp. motor-generator set with four welding circuits, two to the automatic welding heads and two extension circuits for hand welding. The principal part of the welding machine consists of a revolving jig with a roller bed and two circular tie-holding frames, slotted

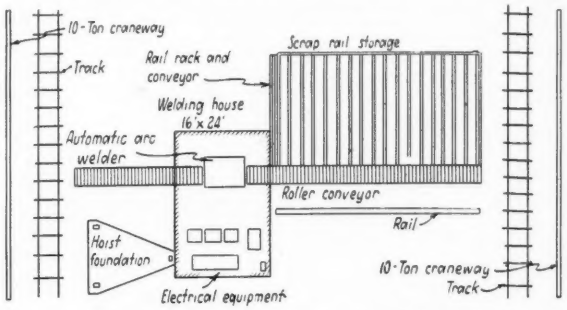
**Scrap Rail Ties Replacing Timber Ties Destroyed by Hot Ashes**

at the center to admit the tie rails. As the roller bed of the jig is at the same level as the approach roller conveyor, the tie rails are pushed directly on to the jig, where they are spaced the proper distance apart by means of spacers. When the tie plates have been placed in position, the various parts of the tie are held rigidly in place by means of two pneumatic plungers extending through the roller bed, which raise the tie rails so that the tie plates are pressed upward, firmly against the ends of a cross bar extending through the circular holding frames. A pair of spring and toggle-operated clamps at each end of the jig hold the angle bars in correct position.

When the tie is assembled and its parts held rigidly in place as described, a hand-operated mechanism rotates the entire jig holding the assembled tie. This rotation can be in either direction through an angle of 45 deg. from the vertical position, permitting automatic welding to take place first on one side of each tie plate and then on the other side.

### Automatic Feature Speeds Fabrication

The automatic arc welding heads of the machine are mounted on travel carriages to the rear and directly above the tie holding jig, and each head, together with its carriage, is arranged so that it will move parallel with the tie on a special track forming




**General Layout of the Tie Fabricating Facilities of the D. & H.**

a part of the supporting framework. The movement of each of these heads is effected automatically by means of two small electric motors. Through special holders extending down from the carriages, the wire electrode of each head is held in such position as to form the welds joining the tie plates and the tie rails properly when the assembled tie is rotated in either direction to the proper position.

In actually forming one of the ties, the tie rails are first rolled on to the machine bed and properly spaced, the tie plates are placed in position, and the pneumatic plungers are then operated to hold the parts in place. The end angles are then placed in position and clamped, after which the jig is rotated to a point where the joints between the tie plates and the head of one of the tie rails are the proper distance from the two electrodes of the automatic welding heads. So arranged, one set of welds is made, during which the welding wire electrode of each head is fed automatically to the weld from a reel, and the electrodes of the two heads move away from each other automatically along the joints being welded. When these welds are completed, the jig is rotated to a point where the opposite edge of each tie plate is directly beneath the automatic welding electrodes, and the other set of welds is made while the arcs move automatically toward each other.

While the automatic welds are being made, two operators, one at each end of the machine, weld the angle bars to the ends of the tie rails by means of a hand arc, welding the side presented according to the position at which the jig has been rotated. When all of the welds have been completed, the jig is turned back to normal position, the pneumatic clamps are released, and the completed tie is rolled on to an extension of the roller conveyor, from which it is picked up by the 1,000-lb. capacity hoist which loads it directly into a car.

As laid out in the Delaware & Hudson plant, the motor-generator set and the separate control panel for each automatic welding head are located directly

in front of the machine, immediately behind the working space of the two welding operators. So arranged, the operators can work largely independent of each other, and can control the welding current by simply reaching to the control levers behind them.

In order to protect the equipment at the plant and to permit the work to proceed regardless of weather conditions, all of the welding equipment is housed within a newly erected Truscon standard steel building, which is 24 ft. long by 16 ft. wide. This building, which is fitted with a plank floor, has window sash along both sides and is of sufficient size to provide storage for all such welding materials as are necessary in the production of the ties.

The entire plant is operated by four men, not including the scrap dock crane operator who spends only a small portion of his time in placing the scrap rails on the receiving rack. Of the four men at the plant, one is employed cutting the scrap rails into eight-foot sections, two work in conjunction with the welding machine, and the fourth man acts as a helper, rolling the rails to the welding machine, keeping the welders supplied with tie plates and angle bars, and loading the completed ties into cars.

### Cost Figures Point to a Real Saving

Based on the present rate of production of the scrap rail ties, which averages about 70 per day, each tie costs as follows:

| | *Cost Per Tie* |
|---|---|
| Materials, including tie parts, oxy-acetylene, welding wire and current, heat, light, etc. | $3.56 |
| Labor, including all operations through the placing of the completed tie into the car | .34 |
| Interest and depreciation, at 6 per cent each on total investment of $10,000 | .06 |
| Total cost of completed tie | $3.96 |

This cost of the scrap rail tie compares with the average price of $3.25 which the D. & H. is paying for its creosoted ties, each equipped with two tie plates. With the completion of further developments now in sight in producing the scrap rail ties, it is estimated that the plant can turn out an average of 80 ties per day, in which event the total cost of each scrap rail tie will be reduced appreciably.

The average life of the scrap rail tie in the track is still a matter of conjecture, although it is expected to be considerably in excess of the average life of a treated timber tie. At points where fires are cleaned on the track there is no question concerning this matter, for large economies have already been effected through the use of the scrap rail ties at these points. In other classes of service also it is entirely probable that the increased life of the scrap rail tie will make its annual cost considerably lower than that of a treated timber tie equipped with tie plates. To this economy which may result there should be added the reduced cost of track maintenance, which is expected in view of present indications; account should also be taken of the salvage value of each of these ties, which is estimated at $2.70.

Cost figures and actual tests of these ties under severe service conditions have convinced the officers of the D. & H. that there is economy in their undertaking, a conviction which is evidenced by the plan of that road to install these ties throughout its yard and engine terminal tracks as fast as production will permit. The fabrication of the scrap rail ties on the D. & H., is under the general supervision of H. S. Clarke, engineer maintenance of way.

# Roadmaster Promotes Safety

IN ORDER to reduce the number of accidents to track forces and to stimulate interest among the foremen in safety matters H. H. Hann, roadmaster of Subdivision No. 2 on the New York, Ontario & Western, compiles a list showing the accidents involving track men on that subdivision in the previous year, in which the date of the accident, the nature of the work, the nature and cause of the injury and the length of disability caused by the injury are shown. As soon as the list is completed, which is done as soon as possible after January 1 each year, a copy is sent to each foreman so that he may be informed as to all personal injuries occurring to trackmen on that territory and take the precautions necessary to prevent similar accidents in his gang. A letter accompanies each list, calling attention to the salient features of the data together with sugges-

N. Y. O. & W. Ry. Co. Personal Injury Reports Year 1927 Sub. Div. No. 2

| Date | Nature of Work | Nature of Injury | Cause of Injury | Length of Disability |
|---|---|---|---|---|
| Jan. 10 | Coaling engines | Gash cut on head | Hit by piece of coal | 1 day |
| Jan. 19 | Storing ice | Stitch in back | Slipped on ice | 14 days |
| Jan. 25 | Unloading ashes | Spine injured | Hit by scoop flying off handle | 21 days |
| Mar. 3 | Unloading coal | Ran nail in foot | Stepped on nail | 9 days |
| Mar. 31 | Unloading material | Foot bruised | Keg of spikes dropped on foot | 1 day |
| May 15 | Renewing ties | Cut between eyes | Head flew off spike | none |
| July 6 | Renewing ties | Blood poison | Blistered foot | 9 days |
| July 23 | Renewing ties | Sprained ankle | Foot caught between point and rail | 7 days |
| Aug. 4 | Renewing ties | Blood poison | Ran sliver in finger | 15 days |
| Sept. 8 | Lighting signal lamps | Hip bruised | Falling off ladder | 13 days |
| Sept. 14 | Raising track | Knocked injured | Stepped on stone and fell | none |
| Sept. 20 | On way to work | Gash cut over eye | Motor car derailed at open switch | none |
| Sept. 30 | Drilling rail | Piece of steel in eye | Hit rail with hammer | 10 days |
| Oct. 14 | Shoveling ashes | Stitch in back | Shoveling ashes | none |
| Oct. 26 | Riding on motor car | Hot cinder in eye | Hot cinder in eye | none |

List of Accidents Sent to Each Foreman

tions as to the steps to be taken to improve the safety record. A copy of the letter accompanying the list for 1927 is shown herewith.

Walton, N. Y., Jan. 23, 1928.

All Foremen:

Each year throughout the United States, safety meetings and conventions are held covering every line of labor, with the idea of improving the conditions under which men are working and with the idea of impressing each individual with the importance of "Safety First."

A great many thousand dollars are spent yearly by the railroads and industries to reduce the number of accidents which occur daily. Unless an interest is taken in this matter by the foremen and men and a study made of the cause of those which have taken place in the past, with the idea of determining those which could have been avoided, a lot of time and money will have been spent in vain. It is not enough for the safety committees to meet and discuss this problem but it is up to each foreman and man to cooperate this year in helping to cut down on the number of accidents.

In checking up on the accidents during 1926, I find that about one-half of them were caused by slipping or by misstepping,—a very simple thing, yet it was the cause of about one-half of the accidents for the year. Quite a number of them could have been avoided; I am not going to say how many, you can decide that for yourselves. However, in the case of the cinder, if goggles had been worn, this accident would have been avoided.

At the end of the year, a letter will be sent to each foreman, giving the numbers of the sections with the name of the foremen who have gone through the year without having an accident in their gangs.

H. H. HANN, Roadmaster.

The practice of sending the list of accidents to the foremen was inaugurated with the compilation of the data for 1926 and it is interesting to note that the injuries in 1927 totaled 15, as compared with 21 in 1926, a reduction of approximately 30 per cent, while accidents due to slipping, which occasioned almost half the injuries in 1926, totaled only two in 1927.

*View of the New Bridge*

# Erect 92-Ton Slabs with Derricks

## Heavy Members for Pennsylvania Bridge Were Delivered on Cars and Set in Place Between Trains

WHILE IT is a matter of almost everyday occurrence for railways to replace steel bridges by rolling new spans in as old ones are rolled out, and it is not uncommon for them to install concrete slab spans weighing over 100 tons by the same method, it is quite unusual to use derrick cars for the placing of concrete slabs weighing much more than 50 tons. But this method was employed in the placing of slabs weighing 92 tons in what is known as the Coal Valley viaduct on the Monongahela division of the Pennsylvania north of Clairton, Pa., which was built to replace a double-track steel viaduct. The concrete structure consists of six spans ranging from 22 ft. 3 in. to 35 ft. long, end to end of slabs, with four slabs per span. Six of the slabs weigh 92 tons each. The work of removing the old bridge and erecting the slabs was completed in two days, some of the slabs being placed in 15 min.

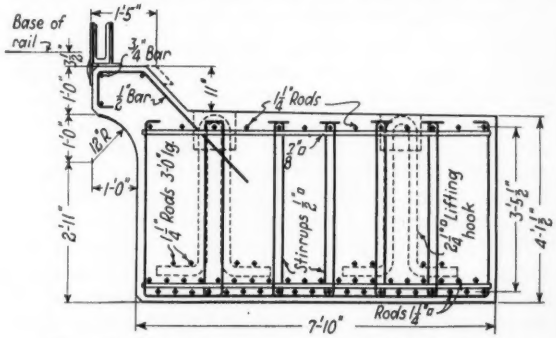
### Slabs Cast Two Miles from Bridge

The old steel viaduct consisted of steel bents carrying plate girders. Span lengths were adopted for the new structure which would permit the new concrete piers to be built in locations where they would not interfere with the old bents and they were finished just below the bottoms of the girders. The piers were built while the precast concrete slabs were being cured in a casting yard, two miles from the site of the bridge. The slabs are 4 ft. thick, and are double reinforced with 1¼-in. square twisted bars. The mix was 1-2-3 with a 3 to 4-in. slump, using ⅜-in. to 1¼-in. graded river gravel and 0-8 river sand.

The removal of the old bridge and the erection of the slabs was completed for one track on one day, and a week later another day was occupied in repeating the operation for the other track. Temporary turnouts were installed at each end of the bridge and the construction forces were given the exclusive use of the track on which the change was being made, being compelled to clear the other track whenever it was required for traffic.

The slabs were set by two derrick cars, one of 100 tons capacity and the other of 150 tons capacity. The smaller derrick car operated on the track for which the slabs were being erected and the larger crane on the adjoining track. The slabs were brought in on cars on the track occupied by the larger crane. The steel of one span was then burned out and the concrete slabs for this span set in place, the inner slab being set first.

The smaller crane moved forward on the concrete slabs after they were set, and the operation was repeated for the next span. The demolished steel structure was handled by a crane of 35 tons capacity, which loaded it on the cars on which the concrete




**Cross-Section Through One of the 92-Ton Slabs**

slabs were delivered to the bridge. This crane also lifted the ties and rail from the span ahead and placed them on the concrete slabs after they were set so that the 100-ton derrick car could move forward. This 35-ton crane operated while the cars on which the slabs were loaded were being shifted. After the slabs for a span were set, the larger derrick car cleared for traffic and the next span of steel was burned loose and made ready to load out.

### Second Operation Occupied Less Time

The same operation was repeated for the second half of the two-track bridge but this operation was completed in three hours less time than the first half. Immediately after the last span was set, the bridge was cleared, and five-ply waterproofing was applied, and then paved with asphalt blocks. This was then covered with hot tar, and the permanent track laid.

The record schedule for placing the slabs for the two tracks is given below:

**South Bound Track**

Started December 12, 11:15 p. m.
Set first slab, 2:15 a. m., December 13.
Set second slab, 2:55 a. m.
Cleared for traffic.
Set third slab, 5:35 a. m.
Fourth slab, 5:40 a. m.
Cleared for traffic.
Fifth slab, 8:00 a. m.
Sixth slab, 8:15 a. m.
Cleared for traffic.
Seventh slab, 10:30 a. m.
Eighth slab, 10:50 a. m.
Cleared for traffic.
Ninth slab, 1:40 p. m.
Tenth slab, 2:00 p. m.
"A"slab, 2:10 p. m.
Cleared for traffic.
Eleventh slab, 4:15 p. m.
Twelfth slab, 4:25 p. m.
Waterproofed and laid asphalt blocks, and put tracks in service at 9:00 p. m., December 13.

**North Bound Track**

Crane moved in at 11:00 p. m., December 18.
Started to burn out steel.
Set first slab 12:20 a. m., December 19.
Second slab, 12:35 a. m.
Cleared for traffic.
Third slab, 1:55 a. m.
Fourth slab, 2:05 a. m.
Cleared for traffic and burned steel.
Fifth slab, 3:10 a. m.
Sixth slab, 3:30 a. m.
Cleared for traffic.
Seventh slab, 4:55 a. m.
Eighth slab, 5:05 a. m.
Cleared and burned steel.
"A" slab set 7:50 a. m.
Cleared and burned steel.
Ninth slab 10:20 a. m.
Tenth slab 10:30 a. m.
Cleared and burned steel and removed old back wall.
Eleventh slab, 12:25 a. m.
Twelfth slab, 12:35 a. m.
Waterproofed and paved the deck and put the track in service at 6:00 p. m.

Note—The "A" slabs were fillers required to compensate for a skew span.

The rapidity with which this work was carried on without interference with traffic demonstrates that units of great weight can be handled quickly and efficiently if adequate equipment is provided. The great weight of long span concrete slabs has often been considered an objection to their use. The 92-ton slabs of the Coal Valley viaduct were not only handled and placed in an exceedingly short space of time but offered at once a completed deck on which track was laid in assembled sections so that the derrick car was carried on newly placed slabs.

The bridge was designed under the direction of Robert Farnham, engineer bridges and buildings (now chief engineer, Philadelphia improvements), Philadelphia. The work of erection was done under the supervision of C. E. Mencken, engineer in charge, Pittsburgh, Pa.

# Surfacing Track When Laying New Rail

By N. F. ALBERTS
General Track Foreman, Atchison, Topeka & Santa Fe, Chicago

MANY railroads consider it necessary to give the track a general raise when new rail is laid, to facilitate the spacing and renewing of the ties, to protect the new rail from surface bending and to improve the riding qualities of the track. While this practice has certain advantages, many men of wide experience do not agree that it is always wise to make a general raise in such cases. They do not, however, condemn the making of a general raise where conditions necessitate it, such as where the track has become so rough that it cannot be surfaced satisfactorily by merely raising the low places, where the ties have become so badly skewed and decayed that heavy renewals are necessary, where the ballast is old and weedy or where it is not sufficient or of the proper quality to carry the traffic passing over it. Where such conditions prevail it is, of course, advisable to give the track a general raise, because by doing so the riding quality is improved and the spacing and renewing of ties can be done more economically.

Since conditions of this kind are rare on first class railroads, the practice of making a general raise where the ties are in fair shape and the track is in fair riding condition is often a waste of time and money; in fact, there are many in charge of track maintenance who agree that in many cases the track rides a great deal rougher after it has been given a general raise than it did before it was raised.

New rail is likely to become surface bent if not properly taken care of, as several trains will pass over it before the surfacing gang can get to it. Even though it is surfaced immediately after it is laid, and before letting any trains over it, the same situation often prevails because of the improper handling of the surfacing. The tamping of the ties is often neglected, especially where a number of inexperienced men are employed, and this not only causes the rail to become surface bent but results in rough riding track from other causes.

### Disturbance of Expansion and Gage

Nothing will interfere more with the proper provision for the expansion of the rail than raising the track, even though it is well anchored and a large percentage of the slots in the joints are spiked. In pulling track from its bed, the ballast becomes loose and the ties are shifted so that they lose contact with the rail anchors, permitting the rail to creep and thereby causing improper expansion.

Unsatisfactory gage always results from this practice, no matter how careful the steel gang may have been in gaging the track when the rail was laid. This is due in part to the ties being adzed improp-

erly, causing the rail to settle out or inward. An excessive amount of tie spacing is also bound to change the gage in some portions of the track and while a little variation of the gage is often disregarded by the surfacing gangs, the general raise of the track usually has a tendency to further distort the gage.

In most cases the track rides as rough, if not rougher, than it did before the surfacing gang went over it, owing to the fact that large extra gangs usually contain many inexperienced men. No matter how careful the foreman may be, it is difficult for him to see that the tamping is always well done. There is so much other work involved in making a general raise that the foreman has little time to see that the ties are tamped uniformly. Uneven tamping, raising track in wet weather, heavy rains after the track has been raised and "kick-outs" in hot weather often cause the rail to hump. When the surfacing gang has left, much attention is required by the regular section gang, not only in correcting the irregularities left by the extra gang, but in going over places where the track was raised during wet weather.

### Expense and Inconvenience of Extra Gangs

Thousands of dollars are spent annually and many inconveniences and delays are experienced by various railroads in assembling large extra gangs and in furnishing bunk cars and the other facilities that are necessary to maintain large camp outfits. Work trains to haul the men to and from the work and the diversion of traffic from the track where the work is to be done not only delay trains but necessitate additional men to operate the crossovers where traffic is diverted.

It is often necessary to use regular section men as flagmen for extra gangs, and sometimes motor cars must be taken away from section gangs as well as section men to operate the cars, for hauling the men to and from work when a work train is not used. This not only causes dissension among the section foremen and their men because they must use hand cars in going to and from work, but it also tends to cripple the regular section program. In most cases a motor car turned over to an extra gang is almost unfit for use when it is returned to the section foreman. This creates ill feeling on the part of the section foreman who must take the time and trouble to put the car in good working order before it can be operated.

### Preliminary Work When Rail Is to Be Laid

The section foreman should be informed where the new rail is to be laid so that, during the winter period when the track is clear of snow and ice, his gang can do the necessary adzing to prepare a level seat for the new rail. This is necessary where the tie plates are to be changed out on account of the new rail having a wider base than the rail taken up. Where treated ties are adzed plenty of creosote must be applied to preserve their life.

As soon as the frost is out of the ground the gang should be increased, the necessary ties unloaded and distributed where needed, if not done previously, and the renewals made where the new rail is to be laid. When this has been done the track should be spotted, that is, all the low places where new rail is to be laid should be raised and well pick tamped. In spotting track or raising low places, it is necessary only to fill the track where the tamping has been done and it is not necessary to dress the ballast.

The steel gang may then proceed with the rail laying, making a complete job, that is, full bolting, full spiking and fully anchoring the rail. There is no possibility of the new rail becoming surface bent as the low places in the track have already been taken care of and the track is in fairly level condition. There need be no chance of the rail creeping, even though some of the slots are not spiked because of the ties not being spaced properly under the joints, since a few additional rail anchors will hold the rail. The section gang can then follow the steel gang and go over the new rail, tightening bolts, tapping down spikes, regaging where necessary, lining track and dressing the ballast. This latter work should not be done until after the old rail and other materials have been picked up.

There may be certain stretches of track where a general raise will be more economical and more helpful to the riding condition of the track. Such places should be checked by the section foreman and the supervisory officers, and the raise should be made by the regular section gang. It is neither constructive nor economical to handle such work with an extra gang where section gangs are already established, nor is it constructive or economical to reduce section gangs to one or two men during the winter period when, if handled properly, there is plenty of work that can be done to advantage at that time, thereby permitting the maintenance of a uniform track force the year 'round.

### Rail Can Be Laid by Section Gangs in Winter

Under the present method of handling work, rail and ties, as well as track fastenings, are frequently unloaded in the spring of the year when the section gangs should be attending to other duties. Many railroads have discontined the practice of unloading rails for renewals by dropping them from flat cars, and are now unloading them with a crane. Such work, as well as that of unloading track fastenings and ties, can be done at any time during the winter, and if this is done it is not necessary to reduce section gangs to one or two men at the beginning of the winter, and to refill them with green men in the spring. When new rail is to be laid and the work is handled as previously outlined, getting the track well spotted before the ground freezes, and the ballast well cleaned away from the ties so that it will not interfere with the rail laying, rail can be laid in the winter as well as in other seasons of the year. This will do away with the practice of employing large steel gangs in the spring of the year. Assembling several section gangs for this work during the winter months when the track is clear of snow and ice, will not only result in a good job of rail laying but will also help to maintain a uniform track force. Every section foreman is furnished with a motor car and is familiar with traffic conditions on his territory, so that there is little possibility of men getting hurt while traveling to and from the work.

Extra gangs should be employed only when new tracks are constructed or when track is reballasted. Even in reballasting track, the extra gangs should make only the first or rough lift and the second or final lift should be made by the regular section gangs. The section foreman takes pride in knowing that it is entirely up to him to maintain his own track and with a uniform gang the year 'round he can train his men so that he can carry on his work efficiently and economically.

*The New Water Facilities Serving the Southern's Shops and Terminal at Spencer, N. C.*

# Southern Makes Important Water Supply Improvements

## New Plant Serving Spencer Shops Embodies Latest Features of Design and Construction

IN THE extensive program of improvements which the Southern railway has been making during the last few years, the modernization of water supply facilities has received much attention. This work, which is designed to extend over a number of years, includes such measures as the more effective spacing of certain water stations, the installation of wayside treating equipment at points where treatment is desirable but where large expense is not justified, and the elimination of old uneconomic steam plants where possible by the substitution of automatically-operated motor-driven centrifugal pumps.

In general, the Southern is not confronted with a difficult water supply problem as regards the character of the water itself. Most of the supplies over the system are taken from rivers or open bodies of water, and the most difficult problem at these points is the presence of silt or other solid matter in suspension. As a rule, the water is comparatively soft, containing less than five or six grains of hardness per gallon, which is the maximum limit generally allowed on the road. Exceptions to this occur, however, as for example, between Bristol, Va.-Tenn., and Chattanooga, Tenn., where the hardness ranges from 8 to 12 grains, and between Birmingham, Ala., and Columbus, Miss., where the hardness is even slightly higher. In such sections, where large capacity treating stations are not required or justified, wayside tank douching equipment has been installed or is being contemplated in the general improvement program, to lower the content of scale-forming solids.

Until the last few years many of the pumping plants on the Southern have been steam operated. The great majority of these are still in service and are being operated economically. At some points, where coal is expensive or the equipment needs replacing, either because it is worn out or of insufficient capacity, electrically-operated duplicate pumping units are being installed, and in many instances arranged for automatic operation. At some points where there were steam pumps, and where the amount of pumping would not justify a duplicate installation of electrically-driven pumps, one such pump has been installed, and one of the old steam pumps maintained in service as a reserve unit.

### Many Important Changes Made

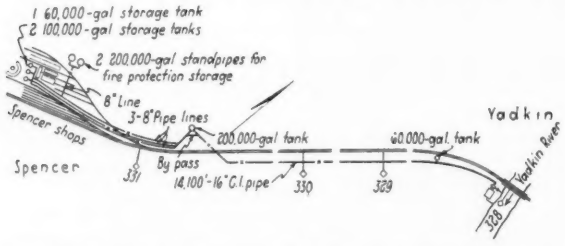
While the Southern's program for the improvement of its water supply facilities has been under way for several years, the major part of the improvement work has been carried out during the last two years. Some of the most interesting work undertaken during this period includes the remodeling of seven important water stations where automatically-operated motor-driven centrifugal pumps have replaced steam-operated pumps, and the rebuilding of another important station, where semi-automatic equipment has been installed. The automatic installations are at Shipman, Va., Gretna, Va., Hot Springs, N. C., Charlotte, N. C., Jefferson City, Tenn., Hodges, Tenn., and Ludlow, Ky., while the semi-automatic station is at Spencer or Yadkin, N. C. All of these modernized stations have now been in service for some time and all have proved so satisfactory and economical in operation that it is expected that the full automatic stations will pay for themselves in from two to three years through the savings effected.

All of these stations are supplied with river water, and with the exception of the one at Yadkin, pump the water to storage tanks without previous sedimentation or treatment. All of the stations are installed with river intake screens, and gravity lines carry the water to concrete suction wells located near the pump houses so as to shorten the suction

lines and thereby make the centrifugal pumps more dependable in operation.

The stations are all equipped with duplicate units of pumps and motors, either unit being capable of meeting the requirements imposed in from 5 to 12 pumping hours. The pumps and motors of these units are direct-connected through flexible couplings, and the motor in each unit is equipped with a separate automatic starting panel. The motors are operated automatically by tank float switches installed in the storage tanks, the motors being started when the water drops between three and four feet in the storage tanks, and stopped when the tanks have been filled to capacity.

To prevent the pumps from losing their priming in the case of foot valve leakage, a by-pass is installed from the discharge line to the suction line, and is kept open, thereby keeping the suction line and the pump well filled with water at all times under a head from the storage tanks. With the installation of these automatic stations, the pumpers were laid off, the old steam pumps were taken out of service, and the plants now require only general




**General Layout of New Yadkin-Spencer Water Supply Facilities**

inspection every few days, primarily in connection with oiling. This inspection work is carried out by signal maintainers who look after the electrical equipment, although section men and pump repairers usually attend to oiling the pumping units. The pump houses at these stations were ceiled with Celotex board to prevent freezing of the pumps and pipe lines.

### Need New Facilities at Yadkin, N. C.

The most important of the new water supply facilities of the Southern is at Yadkin, which serves the extensive shop and engine terminal facilities at Spencer, about three miles distant, where the water requirements are about 1,300,000 gal. per day. This installation is of particular interest because it is new throughout, and includes a large reinforced concrete sedimentation reservoir for removing silt from the water before it is pumped to the storage tanks.

The work on the pumping plant at Yadkin was carried out during 1926 and 1927 in order to meet the plans of the Tallahassee Power Company, which was building a new dam in the Yadkin river, about 20 miles down stream from Yadkin, to regulate the flow of water at its hydro-electric power plant at Badin, N. C. This new dam contemplated impounding a reservoir with a shore line of about 360 miles, which would inundate the old pumping facilities.

Aside from the necessity of renewing the facilities at Yadkin because of the reservoir construction, this was contemplated by reason of inadequate facilities at that point. Briefly, the old facilities consisted of a brick pump house with an adjoining brick boiler house, two old locomotive-type boilers, and two steam-operated pumps which were uneconomical in operation, and of insufficient capacity to meet requirements. The old plant was located near the water level of the river and drew its supply direct from the river without an intake well and without treatment.

### Effective River Intake Box

The new facilities at Yadkin consist essentially of an intake box equipped with rack and screens, a gravity feed line, a suction well, two suction lines, a three-level pump house housing the pumping equipment and chemical feeding apparatus, a sedimentation basin of 2,500,000 gal. capacity, and 16-in. to 8-in. discharge lines to the various tanks of the Spencer water supply and fire protection systems.

The new intake box at the plant is a reinforced concrete structure, located a short distance from the shore line and carried down to a rock foundation. As designed, the box consists essentially of a rectangular well, with 9-in. concrete walls and with an inside area of 5 ft. by 10 ft. 5 in. On the upstream side of the box there is a cutwater of concrete, with its apex three feet from the normal face of the box.

On the downstream side of the box, which is the intake side, is an additional box-like section integral with the main intake well, which supports the rack bars and the screens for excluding debris from the intake. This additional section, which extends across the full width of the main box, is about half the height of the main box, has a battered down-stream face, and a flat platform on top. The racks of the intake, which are held in grooves, are made up of 3-in. by ¼-in. bars, spaced 1¼ in. center to center. There are two of these racks, one extending over an opening 6 ft. 3 in. long by 5 ft. high at the base of the box toward one side, and the other over an opening 3 ft. wide by 5 ft. high toward the other side of the box, but with its lowest point about one foot above the top of the other opening. Water passing through these two racks is separated in the first section of the intake by means of a vertical concrete wall between them.

Directly behind the gratings are removable screens of ½-in. mesh, made of 10-gage galvanized wire. The openings into the main intake well back of the screens are three in number. Two of the openings are back of the larger and lower screen, each of these being about two feet wide by three feet high, and one of them being located at one side and above the other. Both of these openings are equipped with 24-in. by 36-in. sluice gates so that these intakes can be closed off entirely. The other opening into the main intake well is located directly behind the higher screen and rack, and is three feet wide by four feet high. It is not fitted with a sluice gate. Through the arrangement of opening as described, water at ordinary high stages will be taken through the higher opening, while during low stages, the sluice gates of the lower openings can be opened and water admitted through them. In order to permit flushing of the two lower openings, a 2½-in. hose connection is installed at the top of the box, connected with a section of fire hose. Water pressure for flushing is obtained by a connection with the new 16-in. discharge line from the plant.

The feed line from the intake box to the suction well is an 18-in. cast iron pipe, leaving the intake box at a point about two feet from the bottom. This is a gravity line, about 100 ft. in length to the suction

well. The suction well, which is located just outside of the pump house to permit greater efficiency of operation of the pumps, is a rectangular reinforced concrete box, with inside dimensions of 11 ft. long, 6 ft. wide and 26 ft. high. The intake gravity line enters the suction well four feet above the bottom, and this opening can be closed off by a sluice gate operated from the top of the well. Two independent suction lines to the pumps lead from the side of the well opposite the intake, these lines being of 12-inch cast iron pipe spaced six feet apart. The intake ends of both of these lines are fitted with foot valves, the lowest points of which are about one foot from the bottom of the well.

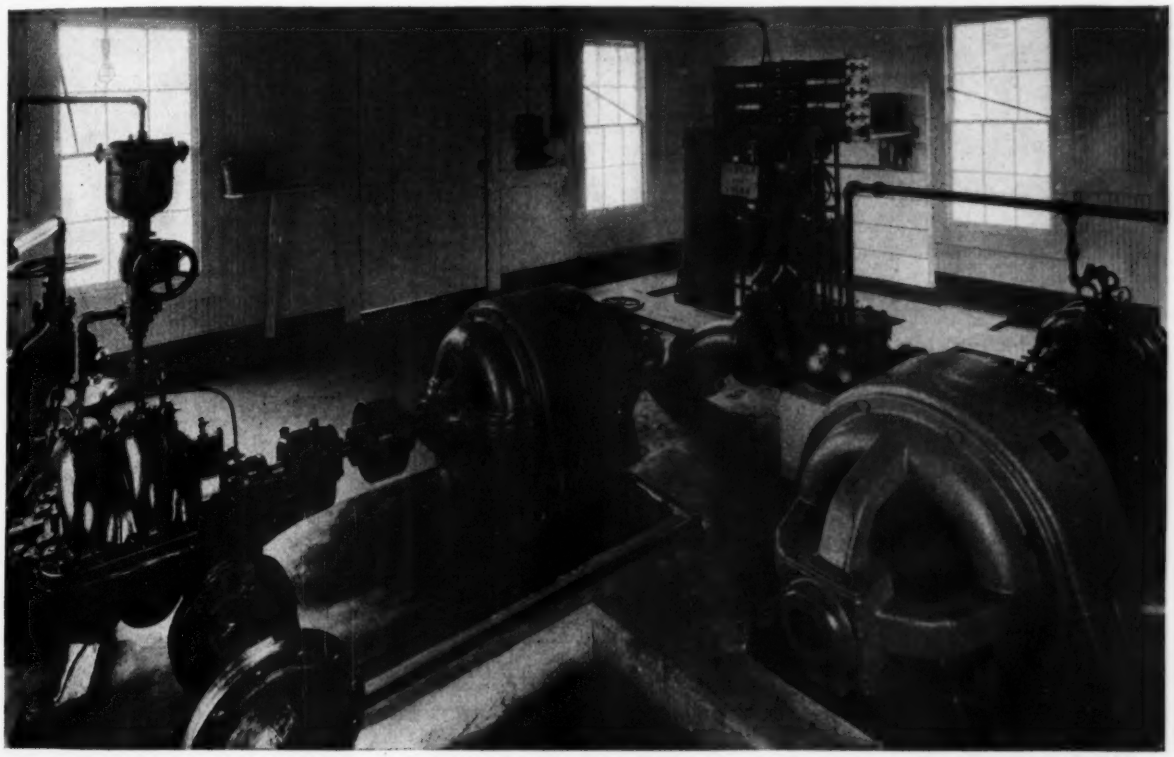
### The Pump House

The pump house, which is about 20 ft. from the suction well, is a reinforced concrete and brick structure, about 43 ft. long by 30 ft. wide, and is laid out with three working levels. The foundation, the floors, and also the side walls up to the highest floor level are of waterproof concrete, above which the upper part of the house is of brick, with a frame roof covered with slate-surfaced prepared shingles. All of the window sash are of steel with center-hung sections to afford ventilation.

In the three-level construction of the house, the top floor is in reality a platform as it extends across only about one-third of the house at one end. This floor, on which are located the chemical treating facilities of the plant, affords entrance to the house, and is reached by a bridge extending from the railroad embankment in front of the house. The second floor, which is at the ground line, is 16 ft. lower than the upper floor and extends across the two-thirds of the house not occupied by the upper floor. On this level are the high pressure pumps to the discharge line. The lowest level in the house is 16 ft. lower than the intermediate level. This level, which is 12 ft. wide and extends across one end of the house, is in reality a waterproof pump well, for within this area are located the low pressure pumps which deliver the raw river water to the sedimentation basin.

### Pumping and Treating Equipment

As with most of the recently remodeled water supply plants on the Southern, the pumping units at the Yadkin plant are in duplicate, and are so arranged that they can be used alternately, one being held in reserve for an emergency. The two low pressure or raw water pumps are Worthington 10-in. single-stage centrifugal pumps of the volute impeller type, with capacities of 1,800 gal. per min. These pumps are direct-connected to two 25-hp. Westinghouse wound rotor type motors, operating on 3-phase, 2,200-volt, 60-cycle current at a speed of 1,200 r.p.m.



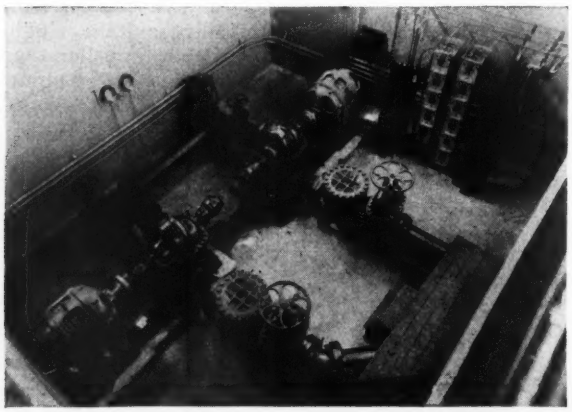
New Equipment at Charlotte, N. C., Which Is Typical of Other Installations Made

The low pressure pumps are protected by gate valves so that they can be taken out of service completely if the necessity arises. From the pumps separate discharge lines of 12-in. pipe rise through a distance of 16 ft. to connect into a 12-in. main which carries the water to the sedimentation basin. Just before this pipe leaves the house, a 12-in. lateral, fitted with a valve, leads off directly to the clear water pumps so that if it should be necessary or advisable at any time, raw water can be pumped direct into the supply lines, by-passing the sedimentation basin.

The two high-pressure or clear-water pumps, are Worthington 10-in., two-stage centrifugal pumps of 1,800 gal. per min. capacity each, direct-connected

to two 250-hp. Westinghouse wound rotor motors. These motors operate at 1,750 r.p.m. on the same power supply as that of the low pressure pump motors. The clear water pumps are fed by a 12-in. line direct from the sedimentation basin, and each pump has a connection within the house to the 16-in. discharge line. Both of the clear water pumps are protected by gate, check and relief valves.

The treating facilities at the plant are designed solely for douching the raw water with alum and dry sodium aluminate in order to bring about coagulation in the sedimentation basin, and to improve the general character of the water. These



**The Duplicate Clear Water Pumps at Yadkin**

facilities, which were furnished by the American Water Softener Company, Philadelphia, consist essentially of two cypress chemical solution tanks of 1,400 gal. capacity each, and orifice feed boxes for controlling the delivery of the alum and sodium aluminate solution to the raw water.

In preparing the chemical solution in either of the tanks, the dry chemicals are placed on a large horizontal dissolving tray within the tank near the top, and are then dissolved by a spray of clear water, admitted through a perforated pipe. The clear water used in making the solution is piped from a connection in the main discharge line from the pumping plant. Agitation of the chemical solution in each tank is by means of a hand-operated paddle agitator.

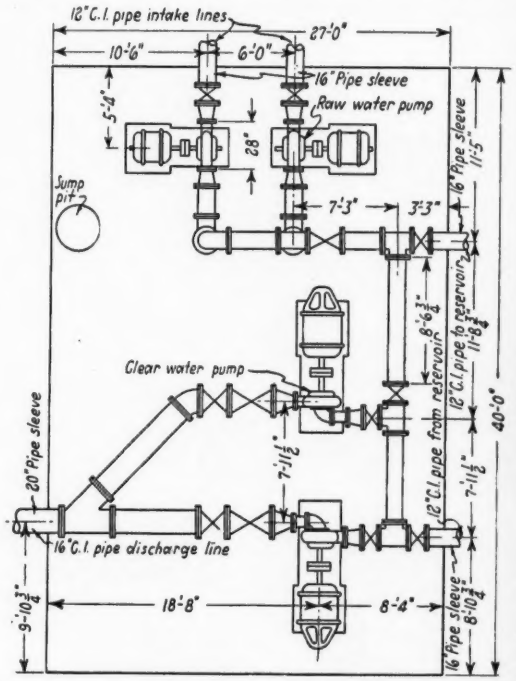
Chemical from the solution tanks is carried through a one-inch brass feed line to the orifice box, which is kept filled to a constant level by means of a float valve. In this box, a hand-regulated valve adjusts the size of the outlet orifice and is provided with a dial whereby it can be set to the proper position, as determined by periodic tests of the raw water. The measured solution passes by gravity to the suction well through a 1½-in. brass pipe line, which terminates directly in front of the mouth of the 18-in. raw water line from the river intake. As already indicated, the douching facilities are manually operated, this type being selected because of the relatively few times during the year when the character of the raw water changes to any appreciable extent.

### Large Sedimentation Basin

The sedimentation basin or reservoir, which is of reinforced concrete, has a capacity of 2½ million gallons. It is 181 ft. long, center to center of end walls, and 144 ft. wide, center to center of side walls. For the purpose of providing additional strength and stability to the structure, and also for directing the course of the water, a heavy longitudinal wall was built through the center of the reservoir, dividing it into two main sections which are further divided into two equal parts by longitudinal baffle walls provided to direct the flow of the water.

### A Reinforced Concrete Structure

The bottom of the reservoir is a six-inch reinforced concrete slab which has a uniform slope from the pump house or intake end, toward the opposite end, dropping about three feet in the length of the reservoir. Because of this, the end walls, and also the side and intermediate walls, vary in section. At the shallow end of the reservoir the wall has a clear height of 12 ft. above the bottom, while at the deep end it has a corresponding height of 15 ft. 5 in. In general, all of the walls have battered faces on both sides, and the footings are of the spread type, vary-




**General Arrangement of Pumping Equipment at Yadkin**

ing from 13 ft. in width for the lower walls to 15 ft. in width for the higher walls. The outside edge of the exterior wall footings is provided with a 4-ft. anchor wall, 20 in. thick to prevent bulging or sliding of the walls, and the center wall footing has a 2-ft. anchor wall through the center for the same purpose. Further stability is given to the outer walls through the banking of earth around the outside to within a few feet of the top.

### The Settling Basin Is Effective

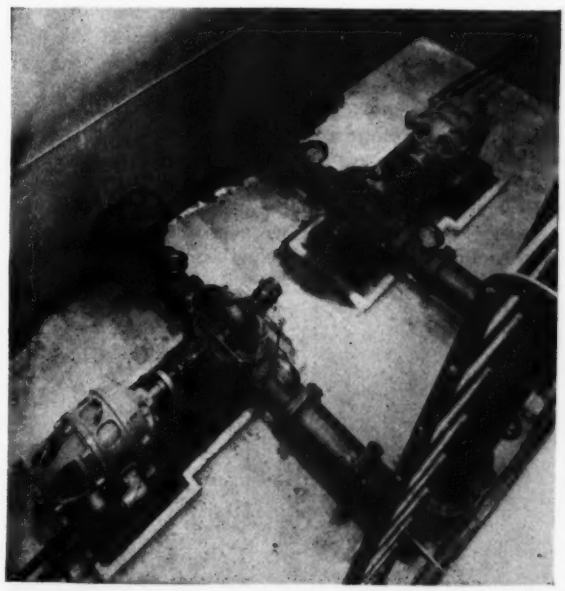
In operation, the douched raw water enters the reservoir through an intake pipe, which is located at about the midpoint in the height of the shallow end wall at the center of one of the outside sections. Immediately upon entering the reservoir, the water is diffused, stilled, and further mixed with the chemical solution by passing through a vertical reinforced concrete stilling baffle, extending across the full width of the reservoir section and provided

with 30 four-inch holes which are spaced uniformly throughout the middle third in its height.

From the stilling baffle the water passes unobstructed through the first section of the reservoir, around the open end of the longitudinal baffle wall, and about half the distance on the return trip, until the flow of its lower section is retarded by a solid reinforced concrete bottom baffle, four feet in height. Beyond the bottom baffle, the surface water is retarded near the end of the reservoir by a reinforced concrete skimming baffle, four feet deep. From this point the water can be drained off to the clear water pumps through a 12-in. pipe outlet in the end wall near the bottom, or it can be made to continue its course around the reservoir, passing under the skimming baffle and up over a weir, the crest of which is four inches below the top of the baffle. The former course might be desired in order to clean the second section of the reservoir, or because sufficient sedimentation in the water had already taken place. Thus, the first half of the reservoir can be operated as a complete unit, and similarly, the second half can be operated separately while cleaning the first half.

### Water Passes Into Other Section

In following the usual course around the entire reservoir, the water passes laterally through a trough back of the weir at the end of the second section,



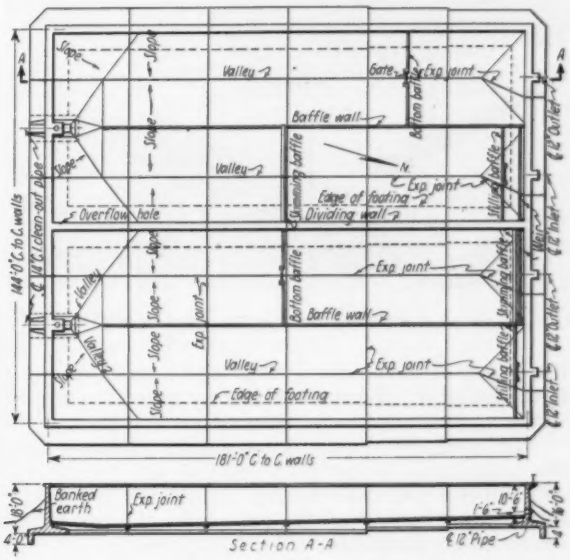
**Looking Into the Raw Water Pump Pit at Yadkin**

this trough being 2 ft. wide by 1 ft. 10 in. deep, and extending into and across the next section of the reservoir. From the extension of this trough the water passes over a second weir in the opposite direction, the crest of this latter weir being two inches lower than that of the first weir.

About eight feet in front of the weir, a perforated stilling baffle retards the flow of the water, which passes on to a skimming baffle at a point about midway in the length of the reservoir. From this surface obstruction the water flows quietly to the far end of the reservoir, passes to the right around the end of the longitudinal baffle wall, and returns on the opposite side of this wall. In the last length of the reservoir there is only one baffle, that being a bottom baffle at about the third quarter point from the deep end. This baffle, as well as the other two in the second half of the reservoir, are similar respectively to those in the first half. The final outlet to the clear water pumps is also similar in detail to the one previously mentioned. All of the inlets and outlets of the reservoir are equipped with gate valves immediately outside of the reservoir wall, these being operated through stands at the top of the wall.

### How the Reservoir Is Cleaned

Cleaning of the reservoir is accomplished independently in each of the two main sections. For this purpose two sludge gates are provided in the deep end wall of the reservoir, which connect with a 14-in. cleanout line emptying into the river below the




**Plan of Yadkin Sedimentation Reservoir**

intake. In order to facilitate cleaning, all of the baffles extending to the bottom of the reservoir are equipped with removable bottom gates at the center, and in order to flush the mud from the floor of the reservoir, four 2½-in. hose connections are installed at the top of the outer walls. The supply pipe for these valves is connected with the 16-in. high-pressure discharge line.

### Operation of System Is Semi-Automatic

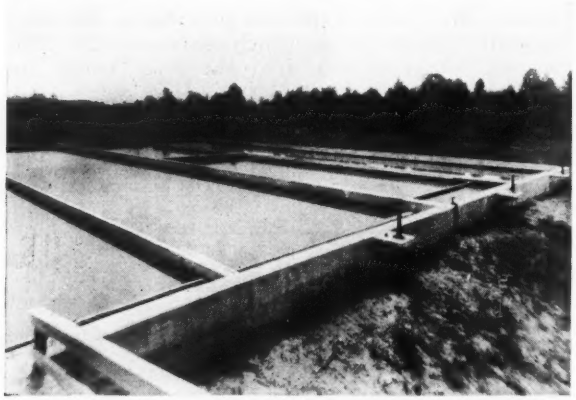
The pumping plant at Yadkin serves five water service tanks and two fire protection storage tanks through 16-in. and 8-in. pipe lines. The 16-in. line, which is 14,000 ft. in length, was constructed of bell and spigot cast iron pipe, and replaces two old 8-in. lines of similar construction. This line was laid along the right-of-way with an average cover of about three feet. In this line the main summits are provided with air relief valves, and the low points are fitted with clean-out gate valves.

The first service tank tapping the line is a 60,000-gal. roadside tank about 2,000 ft. from the pumping plant. The second tank in the line is a 200,000-gal. tank at the north end of the extensive shop and engine terminal layout at Spencer, this tank being at the extreme end of the 16-in. line. From this point three 8-in. lines extend for about 3,500 ft. to a group of three tanks, one of 60,000-gal. capacity, and

two of 100,000-gal. capacity, located near the center of the shop layout. An 8-in. lateral tapping one of these lines serves the two fire protection system storage tanks with capacities of 200,000 gal. each.

### Sequence of Operations

In the operation of the water supply system, the three tanks near the center of the terminal are filled first, these being at about the same elevation and lower than the large tank at the north end of the terminal. When one of the pumps is in operation at the pump house, it will continue to supply water to



**View of the Sedimentation Reservoir at Yadkin**

the group of three tanks until the intakes to these tanks are shut off automatically by altitude pressure valves.

Whenever this occurs, the pumping continues until the large tank at the north end of the terminal is full, when a float switch rings a bell or lights a light at the pump house, and the pumps are stopped by the pump house attendant. The fire protection storage tanks are, of course, maintained full at all times and therefore do not affect the general operation of the water system. In the case of fire however, these tanks can be cut into the line immediately, and, by a system of valves in the main pipe lines, can be supplied by the full output of the pumping plant.

### Float Switch Control

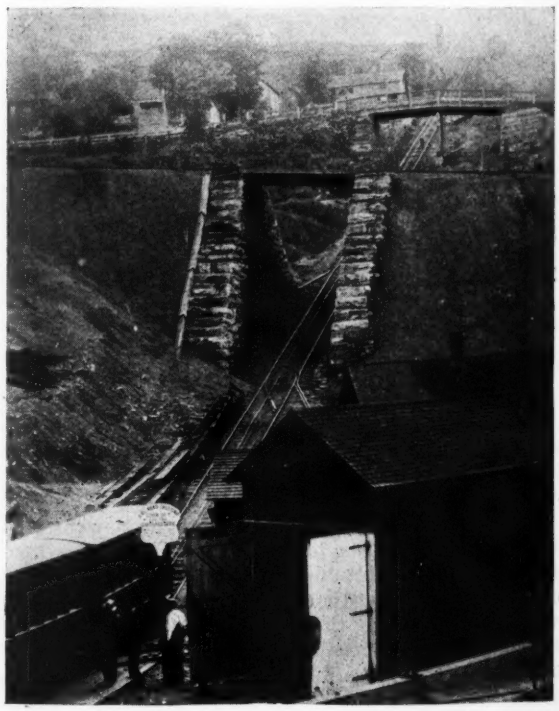
When the water recedes to a predetermined level in the large tank at the north end of the terminal, a float limit switch operates an alarm at the pump house which continues to ring until the attendant starts one of the high pressure pumps. Thus the cycle continues at the pumping plant under the care of three attendants, each working on eight-hour shifts. Through the new installation, the Spencer facilities are assured of an adequate supply of clear water at all times without depending upon the city water supply of Salisbury, N. C., about three miles distant, which was not entirely reliable and decidedly more costly to the Southern.

The new water facilities at both Yadkin and at Spencer were planned and constructed under the general supervision of J. B. Akers, assistant to vice president, and under the direct supervision of A. B. Pierce, engineer of water supply, who has also been in charge of all of the general improvement of the Southern's water supply facilities. The actual construction work on the Yadkin pumping station and sedimentation reservoir was carried out under the direct supervision of J. A. Moir, resident engineer.

## Defective Switch Derails Train

ON OCTOBER 20, 1927, an eastbound passenger train on the Texas & Pacific was derailed at Waskom, Tex., resulting in the death of one employee and one trespasser and the injury of eight passengers and one employee. Following an investigation, the Bureau of Safety of the Interstate Commerce Commission concluded that "this accident was caused by an open switch, due to its defective condition, for which the section foreman is primarily responsible.

"Immediately after the accident the switch points were found to be open, but the switch lamp was displaying a clear signal, indicating that the switch was closed, and the switch was locked for a main line movement with the lever in the socket. The connecting rod, however, was disconnected from the bridle rod and that portion of the safety strap on the bridle rod intended to prevent such an occurrence had been broken off. The base of the safety strap remained riveted to the bridle rod and examination disclosed it to be badly corroded and rusted. Apparently the metal of the safety strap had been eaten away by rust to such an extent that it was easily broken, if, in fact, it did not drop off of its own weight. It was not definitely determined how the connecting rod became disengaged from the bridle rod; it might have been jarred off by the vibration of passing trains or it could have been lifted off by hand. In either event, the result would be that the switch points would spring open, and the evidence indicated that this was what occurred in this instance, resulting in the derailment of train No. 22. The section foreman inspected, oiled and greased the switch and its appurtenances and adjusted the points about 13½ hours prior to the occurrence of the accident, and if he had exercised due care in this inspection there is no reason why he should not have noticed the corroded condition of the strap."



**The D. & H. Incline at Honesdale, Pa., Built in 1827**

*The Plank Crossing Is the Oldest Type*

# Highway Crossing Construction Imposes Many Problems*

## An Analysis of the Requirements of a Satisfactory Pavement for This Important Purpose

By F. W. HILLMAN

**Assistant Engineer Maintenance, Chicago & North Western**

IT IS not so long ago since it was a simple problem to keep crossings of highways and railways in a fair condition. The average section gang could take care of them easily and the smooth riding of crossings was not emphasized. However, with the advent of the automobile came a great increase in the volume and speed of highway traffic. Demands were made for smooth riding streets and complaints about rough riding crossings became frequent. Sometimes we felt that it would be a good thing to leave the crossings rough and announce to the world that they would be rough so that drivers would be more careful at the crossings. We soon learned that this would not work; the public made strenuous objections to it that we could not ignore. Rough and unsafe crossings certainly do not make for a favorable attitude toward the railways and the railways need the good will of the public as never before.

Another thing that stimulated the study of the old crossings was the frequent picking up of loose planks by dragging brake rigging. We began to remove them in the less important crossings and put in stone screenings. Sometimes attempts were made to do this on some fairly important highways, but not always with success. Then the increasing cost of planks and the thought that they were expensive to install and maintain intensified this study and we began to look around for substitutes. There are many types of crossings to choose from but before considering them, it will be well to give consideration to some of the essentials of a good crossing.

First, we cannot stress too much the need of a good foundation, which is really the track structure. There should be good drainage and this is the most important. There should be plenty of good ballast, solidly placed. Ties should be durable and for some types of crossings should be sawed. Tie plates should be used and as far as possible rail joints should be eliminated. This can be done with the use of long rails or by welding rails together. In short, the track structure should be as perfect as the means at hand will permit. The advisability of attempting to make a good crossing, if the track cannot be put in first class shape is doubtful. The best results are obtained if, after the track is made as good as possible, it be left for a short time to allow traffic upon it to develop defects which can be adjusted before putting on the crossing material.

Then the cost should be reasonably low. There are so many crossings to fix, with a limited sum to spend, that something is desired which will permit improving as many of them as possible. The first cost should not be the controlling factor, although frequently it must be. Serious thought should be given to the annual charges for maintenance, interest and depreciation. The crossing material should be easy to apply without special equipment and specially trained men as much as possible. It should be easy to repair, easy to remove and replace with the least loss or destruction of materials.

### Should Permit Easy Removal of Rails and Ties

The design should be such as to permit easy removal and renewal of rails, fastenings and ties. In one instance it took the good part of a day to replace a broken rail in a screenings crossing where the wheels made their own flangeway and the screenings were frozen solid. This feature of easy access to the rail will also simplify the shimming of the track. Some have said that if the track is built properly, it won't heave and need shimming. Do you shim the spot which heaves? And are you sure that the track on each side of the crossing will not heave?

The crossing material should be well compacted

*A paper presented before the Maintenance of Way Club of Chicago on April 18.

and have a fairly smooth surface. Loose materials are likely to be rolled into the flangeway and be a probable source of derailment. There have been derailments where this was thought to be the cause. However, the surface must not be so smooth that it will become slippery and cause vehicles to skid. This is particularly important on skew crossings made of rails or metal plates.

### Effect on Signals

In automatic signal or train control districts and wherever there are track circuits, care must be taken to see that the construction is such that short-circuiting will not occur. This feature must be watched particularly at crossings built with stone screenings, cinders or dirt where wheels cut their own flangeways. It must also be considered carefully in metal crossings and probably in concrete crossings. Bituminous material crossings do not offer this problem.

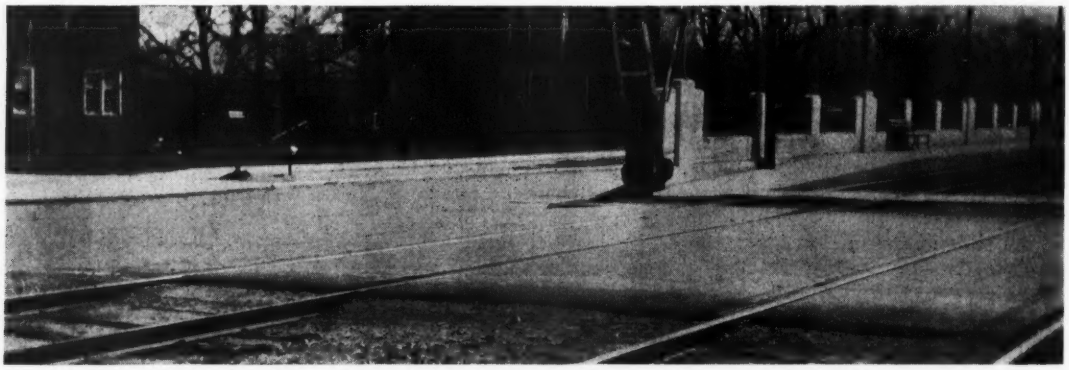
The life of the crossing material should be fairly long; however, the question might be asked, can it be too long? Is there any need of its being any longer than the life of the track structure? It has to be torn out when renewing track. Will this not depend on the type of material used? This may offer an argument for crossings made of concrete planks or slabs, metal plates and rails.

The crossing should be waterproof or at least shed water in order that it will not percolate into the roadbed and in winter cause the trouble with which all maintenance men are familiar. Attention must be given also to the design of the ends of the crossing. There must be no projections to catch dragging parts of equipment.

### Surface of Crossing Is Important

A recent design of a concrete crossing has its top surface ⅜ in. below the tops of the rails. This seems ill-advised because the usual complaint of roughness is caused by bumping on the rails. Bituminous and screenings crossings which have settled below the top of rail are certainly rough riders. One state requires all crossing surfaces to be slightly above the top of rail. This is in the northern country where there is still a lot of sleighing. It is claimed that sleds have become frozen or stuck to the rail and could not be moved in time to avoid an accident. Solid-rail and metal crossings are, therefore, discouraged in that state. One city demands the solid-rail type. It would seem better to have the surface made slightly above the rail to allow for wear of the material and for the compacting of certain materials, so that the surface will never be below the rails. This may not apply to some types of construction, such as metal plates or rails. However, serious consideration must be given to the possibility of vehicles skidding on the rails at skew crossings. Such an occurrence recently resulted in a serious accident.

The details of the construction next to the rail, including the width and depth of flangeways, is important. The design, as stated before, should be such as to permit the easy removal and renewal of rails and fastenings. Many advocate placing bituminous materials close to the rails and letting the wheels cut their own flangeways. It is impossible in such construction to prevent the wave motion of the rail from breaking up this material next to rail. With such materials this can be overcome in part, but not entirely, by making the material next to rail more plastic by adding asphalt. On the outside of the running rail there should be a good wood plank or its equivalent, in a compressed bituminous block or other fairly pliable material that will not be easily broken by the rail motion or crushed by false wheel flanges.



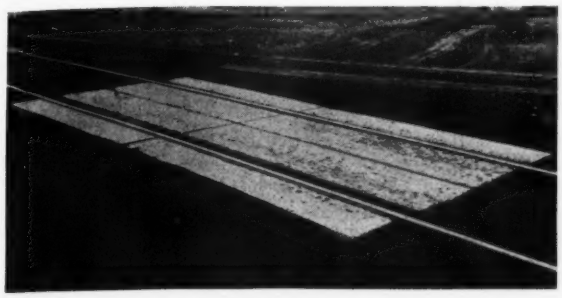
**Bitumastic Crossings Are Widely Used**

Some sort of flangeway should be provided. It is interesting to note that in 1924 a few railroads reporting to the A. R. E. A. said they did not provide flangeways, but allowed the wheels to do so. A year later most of these same roads reported that they had decided to construct flangeways and not to depend on the wheels. This is done by using planks, rails or special fittings, and filling the open space with wood or an asphalt mixture low enough to provide sufficient depth for the flanges.

### Construction of Flangeways

One construction advocated is to put a rail right side up on each side of the running rail, filling the space between the rails to a proper depth with a good, pliable asphalt mixture. The inside rail should not be laid on its side with the head against web of running rail, because when the crossing surface wears down the edge of the rail flange forms a sharp projection for wheels to strike against. Furthermore, unless a special device is used for holding it in place, the rail will tip. There are some specially constructed flangeways, many of which are in use. An objection to most of them is that the paving must be torn up to get them out. Some types are made from compressed asphalt or compressed asphalt rag fiber and mineral matter which seem to have promise. A good plank on the outside, a two-inch by four-inch piece laid flat and into web of running rail, and another good plank inside makes good construction. Asphalt

can be poured into the joints if desired for sealing. We have crossings built this way without sealing which are very satisfactory. These suggestions apply to track over which there is heavy and high speed traffic, and it is probably not necessary to be so particular on light and slow-speed tracks. We made a natural rock asphalt crossing where the track ran for



A Concrete Slab Crossing

quite a distance in a heavily traveled street. A rail with head up was placed on the inside, half filling the flangeway space with hot asphalt and increasing the depth of the asphalt next to the rail opposite the flangeway. This has stood up well for over three years.

### The Problem of Flangeways

Most of the patented flangeways or flangeway guards are quite expensive as compared with plank and few of them, except possibly those of compressed asphalt or asphaltic mixtures, take care of the outside of the rail. There is a recent design of a combination tie plate and rail chair with slots to engage the rail and to leave a three-inch opening on each side which are filled with asphalt to proper depths. A recent design for a concrete plank crossing provides for two-inch by four-inch sticks laid flat and against the web on each side of the rail to act as a filler between the

An Example of a Rail Crossing

rail and the concrete plank, thus leaving two openings on each side of each rail. This doesn't seem advisable as there are four instead of two openings for vehicles to run over with more of a tendency to bump on the rail.

The depth of the flangeway is important. Where wheels have been allowed to cut their own flangeways they are only as deep as the wheel flanges and there is no extra space for anything which may roll in to get below the wheels and thus tend to derail them. In view of these considerations, it would seem that the flangeway should be as deep as possible and yet have enough material to seal the bottom. This might also be an argument for wide flangeways, but the question arises as to how large a piece shall be provided for. Then, too, while the horse is not as frequent as he used to be, he is still with us and just as likely as ever to catch his hoofs in flangeways.

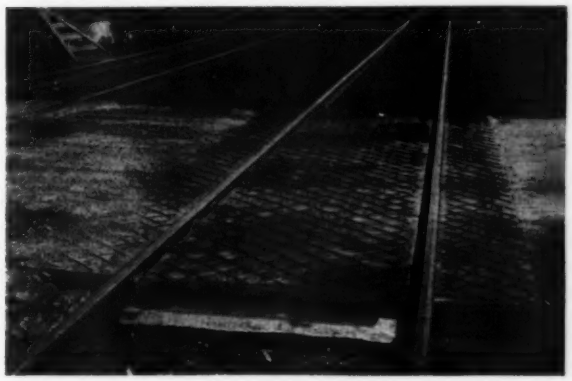
### Different Types of Crossings

The different types of materials and construction used in making crossings might be divided as follows:

Dirt, cinders, stone screenings or gravel crossings.

Wood crossings such as planks or narrow strips assembled as a laminated construction. This latter type was advocated quite forcibly by one of the state highway commissions a few years ago.

Bitumastic materials. These include the natural rock asphalts; premixed materials in which the stone is given a special treatment, then impregnated and mixed with asphalt and shipped ready to lay; the mixed-in-place asphalt concretes, and the penetration



A Recent Design of Metal Crossing

method of spreading layers of stone or gravel and pouring asphaltic substances over them, some of these substances being applied cold.

Concrete planks and slabs.

Metal types, such as cast steel plates with ridged surfaces and rails laid close together.

Special types, such as compressed asphalt, rag fiber and mineral matter planks, compressed rubber planks, compressed asphalt bricks, bricks, granite blocks and wood blocks.

### Two General Groups

These may be divided into two general groups in so far as the type of foundation is concerned. First, those, such as concrete planks and rails, which take their bearing entirely on the ties and require a uniform tie surface; second, those such as screenings and bituminous material which take their bearing on the ties and ballast. Where there is some doubt as to securing a firm foundation, the first type may be preferred. However, as stated before, if a good foundation is not obtainable the advisability of putting in expensive materials is to be questioned. The grade of the adjacent paving must not be forgotten, as the track and crossing may have to be raised frequently to maintain the proper surface.

Crossings made of dirt, cinders, gravel or stone screenings are more or less temporary makeshifts and, with the possible exception of stone screenings, are to be considered only for minor crossings. Some

very good crossings of this material have been in service under fairly heavy traffic. They will form chuck holes easily and need attention. Often these are simply filled with fresh screenings which are soon blown out. This may be overcome to quite an extent by giving the screenings a coating of heavy road oil. We have three crossings of main trunk highways where this is done. Here the flagmen are provided with a small supply of screenings and oil to patch up the crossing when needed. Stone screenings have been mixed with coarse salt, but I have no knowledge as to what service they have given. All of the materials in this group, except possibly clean gravel, will short signal track circuits if allowed to lie next to the rails.

I believe wood crossings have been complained of primarily because of the manner in which they have been put in, since usually their installation has been left to the section men without proper tools. When put in properly by men accustomed to working with wood they have given excellent service. The cost is subject to question, but is low as compared to most of the many materials used.

### Bitumastic Crossings

Bitumastic materials are very popular and make excellent crossings. Very little, if any, extra equipment or skill is needed in their construction if there is someone at hand who can read the instructions usually furnished. The natural rock asphalts are probably the most easily laid. They are also fairly easily repaired. We had one crossing of this material under extremely heavy highway and rail traffic for almost five years and with but little attention. We have others that have stood up well for three years and seem good for more. There are a few cases where the material seems to have granulated, which makes one believe that the bitumen content was low. There is the objection, or possibly inconvenience, of having usually to buy this material in carload lots, although there is one concern which will furnish it in drums.

The other bitumastic materials mentioned have all the physical advantages of natural rock asphalt. In cases where they are mixed on the job, either cold or hot, some special equipment and additional skill may be needed, although not much. These materials seem to be more durable, possibly because they are laid with a greater depth, and possibly because of the better bitumen content. Some of the pre-mixed materials can be obtained in bags so that small quantities may be had for patchwork. These materials should not be ordered too far in advance of placing in the crossing, as they are likely to deteriorate if stored out in the weather too long. This is not the case with natural rock asphalt. It is claimed that this material can be left out in the weather an indefinite length of time without injury to it. It is also claimed that it can be removed from a crossing and used over again. Crossings of the bitumastic type are used very extensively in the East and are becoming popular in the Middle West.

### Concrete Plank Construction

Concrete is also being used extensively. One railroad began the extensive use of concrete planks and slabs 10 or 12 years ago. About three years ago this road reported that it was discontinuing their use. On the other hand, another large railroad is using a great amount of concrete plank, and installed many of them in crossings last year. We have a few on our line, but only one having been in very long. This has been in about ten years and is of the small slab rather than the plank type. It began to show cracks a few years ago, but this may be due partly to foundation failure. The others look very well. The weight of the usual unit, about 500 lb., making them difficult to handle, is objected to, and there has also been trouble with the crushing of the slab just outside of the rail. Their cost is relatively high, but is felt to be justified by many because of their assumed long life, which, however, has not yet been determined definitely.

There is on the market a type of plank made of compressed asphalt, rag fiber and mineral matter, and still another made of compressed rubber. In installing these, a sub-foundation of wood plank, preferably treated, is laid on the ties, and on this the composition planks are laid flush with the top of rails, special blocks being made for use next to the rail. Both types are non-conductors of electricity and present no particular problem in signal territory. An asphaltic plank crossing on our line has been in about one year and is holding up well.

### Metal Crossings

There is a cast metal crossing on the market which seems to have promise. Its first cost is higher than some of the other types but I have been advised that there are crossings of this type on heavily traveled highways, which has given good service for a long time.

Another type of crossing to be considered is that made of old rail. Scrap rail is generally used and, as there is always an abundance of it on hand, they are fairly cheap, if the cost of the rail is not considered. However, the rail has a value and accounting rules require that its cost must be included. This type of crossing is an excellent one and will stand very hard usage. The space between rails can be filled with any kind of material desired. I saw one in St. Louis, which is subjected to exceedingly heavy highway and rail traffic, which had not been touched in 10 years, at least, except for an occasional filling of the spaces between the rails with an asphaltic material. There are some on the Southern Railway in St. Louis which have given excellent service for 15 years. The rails stiffen up the track in good shape, but it is sometimes asked if they do not make it too stiff for high speeds. Both of these metal types of crossing must be insulated in signal territory, special provision being made in the metal plates. Where rails are used one can be left out and a good plank used in its place.

### Special Types

Bricks of compressed natural rock asphalt are on the market, and they too are laid on a sub-plank foundation, which adds to the cost wherever used. This sub-plank also has the disadvantage of being out of sight and not easily inspected. Regular paving bricks, granite and wood blocks have been used. Usually this is where the village or city streets are paved with them and the railways have been made to use the same construction. None of these are very satisfactory unless the track is imbedded in concrete and that introduces an added expense both in initial cost and maintenance, particularly in heavy-traffic tracks. There are some satisfactory installations in light traffic and switch tracks.

The question of comparative costs has so many angles that it is somewhat difficult to discuss. Con-

sidering first costs only, the cheapest would be the bituminous, followed in order by wood plank, rail, concrete and cast metal. Considering, however, the life of these materials, interest, depreciation, maintenance and cost of taking up and relaying each four years in order to surface the track, this will undoubtedly be changed. At present the life of some of the materials can only be estimated. In comparing costs the expense of preparing the track should be given careful consideration and care taken to see that it is not unfairly charged to expense for the crossing installation. All of this discussion has particular reference to crossings of highways and railroad tracks and not to tracks running in streets. The latter is a subject for special study which involves the question of permanent roadway.

It would not be fitting to close this discussion without mentioning the question of maintenance. Often after a good crossing has been installed the idea becomes prevalent that it can be forgotten. This is absolutely wrong. Some little defect may develop which can be easily and cheaply remedied, and the crossing kept in good condition, but which, if neglected, may result in its quick destruction, consequent chagrin at having wasted good materials, and justified criticism.

# A Pipe Culvert in Unstable Ground

IN replacing wooden trestle bridges with pipe culverts difficulty is often experienced on account of the settlement of the pipe, owing to the soil being of a mucky material which is incapable of supporting any considerable load. Such a condition was encountered recently by a railroad in the middle west in the replacement of a wooden trestle on its line near Wolcottville, Ind., where special precautions were taken to afford a foundation for the pipe and to provide against the disjointing of the pipe in case of uneven settlement.

At this point the soil consists of a soft marl, and in order to distribute the load a platform of old bridge stringers was installed on which to lay the pipe. In constructing this platform the marl was first leveled off to an elevation below the flow line for the full length of the proposed culvert and for a width of about 15 ft. Three lines of old 8-in. by 16-in. bridge stringers were then embedded lengthwise of the trench to serve at mudsills and on these a platform of similar bridge stringers, from 14 to 16 ft. long, was constructed, the stringers being placed at right angles to the mudsills.

On the platform thus provided, a 60-in. Armco corrugated pipe culvert was placed, this type of culvert being selected because of its flexibility and

**The Culvert Assembled on the Foundation Platform**

ability to withstand uneven settlement without becoming disjointed and thus losing its efficiency by becoming clogged with dirt.

When the pipe had been placed on the platform, end walls of sod were placed at the ends of the culvert and the trestle was filled with sand from drop-bottom cars. The completed culvert has not only eliminated the cost of maintaining the trestle but has increased safety of operation by providing a continuous roadbed over the site of the former opening.

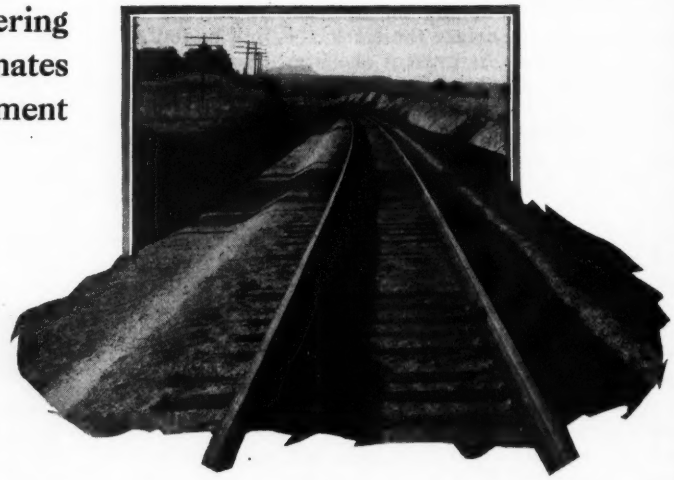
**Piers for the West Approach to the New Cleveland Union Station—Tower of the Headhouse in the Background**

# Determining the Throw for a Curve*†

## Explanation of the Steps Entering into the Selection of the Ordinates for the Revision of the Alinement

### Part 2

By CHARLES H. BARTLETT



IF THE throws required to line a given curve are not excessive, or if it appears that, for reasons of its own, a railroad does not wish to limit the amount of throwing of the actual track, it is usually advisable to attempt to obtain a perfectly regular curve. If we take the curve used in the previous article, we shall see the method of applying the principles in order to obtain a curve which is regular throughout, without even the slight variations which characterized the solution described in the May issue. In addition to this we shall be able to find out just how much it would have been necessary to throw the track to obtain that regular curve and, therefore, what the amount of the throw would have been if the work had been done with a transit instead of with a string.

Let us assume for the purpose of this illustration that we carry straight through to the end of the curve the spiral 0, 4, 7, 11, 14, and 18, with the average revised ordinate of 20; that is, continue the curve which was started in the article in the May issue, Page 214, and then abandoned because the half-throws ran above the assigned limit at Station 19. We have the following:

| Station Number (A) | Original Ordinate (B) | Revised Ordinate (C) | Difference Between Original and Revised Ordinates (D) | Sum of Errors to and Including Station (E) | Half Throw (F) |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 5 | 4 | 1 | 1 | 0 |
| 3 | 7 | 7 | 0 | 1 | 1 |
| 4 | 9 | 11 | — 2 | — 1 | 2 |
| 5 | 9 | 14 | — 5 | — 6 | 1 |
| 6 | 16 | 18 | — 2 | — 8 | — 5 |
| 7 | 34 | 20 | 14 | 6 | —13 |
| 8 | 23 | 20 | 3 | 9 | — 7 |
| 9 | 12 | 20 | — 8 | 1 | 2 |
| 10 | 15 | 20 | — 5 | — 4 | 3 |
| 11 | 25 | 20 | 5 | 1 | — 1 |
| 12 | 20 | 20 | 0 | 1 | 0 |
| 13 | 13 | 20 | — 7 | — 6 | 1 |
| 14 | 19 | 20 | — 1 | — 7 | — 5 |
| 15 | 28 | 20 | 8 | 1 | —12 |
| 16 | 25 | 20 | 5 | 6 | —11 |
| 17 | 28 | 20 | 8 | 14 | — 5 |
| 18 | 24 | 20 | 4 | 18 | 9 |
| 19 | 16 | 20 | — 4 | 14 | 27 |
| 20 | 8 | 20 | —12 | 2 | 41 |
| 21 | 13 | 20 | — 7 | — 5 | 43 |
| 22 | 17 | 20 | — 3 | — 8 | 38 |
| 23 | 17 | 20 | — 3 | —11 | 30 |
| 24 | 34 | 20 | 14 | 3 | 19 |
| 25 | 18 | 20 | — 2 | 1 | 22 |
| 26 | 13 | 20 | — 7 | — 6 | 23 |
| 27 | 10 | 20 | —10 | —16 | 17 |
| 28 | 32 | 20 | 12 | — 4 | 1 |
| 29 | 18 | 20 | — 2 | — 6 | — 3 |
| 30 | 20 | 20 | 0 | — 6 | — 9 |
| 31 | 20 | 20 | 0 | — 6 | —15 |
| 32 | 33 | 20 | 13 | 7 | —21 |
| 33 | 13 | 20 | — 7 | 0 | —14 |
| 34 | 14 | 20 | — 6 | — 6 | —14 |
| 35 | 31 | 20 | 11 | 5 | —20 |
| 36 | 22 | 20 | 2 | 7 | —15 |
| 37 | 17 | 20 | — 3 | 4 | — 8 |
| 38 | 17 | 20 | — 3 | 1 | — 4 |
| 39 | 16 | 15 | 1 | 2 | — 3 |
| 40 | 4 | 10 | — 6 | — 4 | — 1 |
| 41 | 8 | 5 | 3 | — 1 | — 5 |
| 42 | 2 | 0 | 2 | 1 | — 6 |
| 43 | 0 | 0 | 0 | 1 | — 5 |

In the column headed sum of errors, we have a total of +1, which means that the total of the original ordinates is greater than the total of the revised ordinates by 1. In the half-throw column, we have a residual half-throw of —5. We must correct the column headed sum of errors first, in order to simplify the calculations. This can easily be done by making the last ordinate of 20 a 21. We then have

| Station Number (A) | Original Ordinate (B) | Revised Ordinate (C) | Difference Between Original & Revised Ordinates (D) | Sum of Errors to and Including Station (E) | Half-Throw (F) |
|---|---|---|---|---|---|
| 38 | 17 | 21 | — 4 | 0 | — 4 |
| 39 | 16 | 15 | 1 | 1 | — 4 |
| 40 | 4 | 10 | — 6 | — 5 | — 3 |
| 41 | 8 | 5 | 3 | — 2 | — 8 |
| 42 | 2 | 0 | 2 | 0 | —10 |
| 43 | 0 | 0 | 0 | 0 | —10 |

We can now correct the residual half-throw to zero by picking any two ordinates whose station numbers differ by ten, substracting unity from the one having the lower station number and adding unity to the one having the higher station number, in accordance with the rule that when the final half-

*This is the fifth of a series of six articles on the string lining of curves, describing the manner in which the line can be corrected by the track men without the use of instruments other than a piece of string and an ordinary rule. The first article of this series, which appeared in the January issue, Page 4, presented the merits of this practice in contrast with the use of a transit. The second article, which was published in the February issue, Page 62, described the methods of taking the measurements. The third article, which appeared in the April issue, Page 168, presented the basic principles underlying this method of determining curve alinement. The fourth article, which appeared in the May issue, Page 212, discussed the method of selecting the revised ordinates for a curve to give the minimum throw. The sixth and concluding article, which will appear in the July issue, will describe the manner of placing the stakes preliminary to the actual lining of the curve.

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throw is negative we add to the ordinates near the bottom of the page and subtract from those near the top of the page. In order to reduce the work of making the change, let us pick the ordinates as close to the bottom as we can conveniently. We shall select, then the two ordinates at Stations 29 and 39, adding to the one at 39 and substracting from the one at 29. We have

| Station Number | Original Ordinate | Revised Ordinate | Difference Between Original and Revised Ordinates | Sum of Errors to and Including Station | Half Throw |
|---|---|---|---|---|---|
| (A) | (B) | (C) | (D) | (E) | (F) |
| 29 | 18 | 19 | — 1 | — 5 | — 3 |
| 30 | 20 | 20 | 0 | — 5 | — 8 |
| 31 | 20 | 20 | 0 | — 5 | —13 |
| 32 | 33 | 20 | 13 | 8 | —18 |
| 33 | 13 | 20 | — 7 | 1 | —10 |
| 34 | 14 | 20 | — 6 | — 5 | — 9 |
| 35 | 31 | 20 | 11 | 6 | —14 |
| 36 | 22 | 20 | 2 | 8 | — 8 |
| 37 | 17 | 20 | — 3 | 5 | 0 |
| 38 | 17 | 21 | — 4 | 1 | 5 |
| 39 | 16 | 16 | 0 | 1 | 6 |
| 40 | 4 | 10 | — 6 | — 5 | 7 |
| 41 | 8 | 5 | 3 | — 2 | 2 |
| 42 | 2 | 0 | 2 | 0 | 0 |
| 43 | 0 | 0 | 0 | 0 | 0 |

The curve is now lined. In order to avoid making any more 21s out of the 20s, and because the 20 at Station 38 had previously been changed to 21, thus making it advisable to increase one of the ordinates of the spiral to keep the change between ordinates in keeping with that between other terms of the spiral, we increased the 15 of the spiral to a 16. As the station number of this ordinate was 39, we were compelled to pick Station 29 for the other station whose ordinate was to be changed.

### An Important Point

In connection with the method of changing the final half-throw back to zero, the reader will note, if he examines the method closely, that at each succeeding station after the one whereat the first change was made, the half-throw is less by the difference in station numbers from the point of change than it was for the curve which had the residual half-throw. This is true for any curve, whether it is lined or not. That is, if we have a curve which is, say, half-finished, and we find that a certain group of throws is exceeding the desired limit, we can arbitrarily decrease that half-throw by any given amount simply by changing one or two of the ordinates a given distance ahead of the point where the half-throw is too large. To illustrate:

Suppose that we have reached the 49th station of a curve, with a half-throw of —71, which is too high to suit our purposes; we wish to change that half-throw so as to bring it to some such figure as —41. In order to do this, we have only to go back 30 stations to Station 19, and decrease the revised ordinate at that station by unity. This, also, is a valuable asset of the method.

Another valuable application of this same principle can be made when the column headed sum of errors, and the column of half-throws have the same sign at the last station. Suppose that we arrive at the last station with a sum of errors equal to +3, and a final residual half-throw of 46. We can divide 46 by 3, which gives us 2 units of 15 and one of 16. By increasing the ordinates by 2 at Station 15 back of the last station and by 1 at Station 16 back of the last station we make both columns equal to zero at the end, and the curve is lined. To make this a trifle clearer, let us suppose that the number of the last station is 53; then by adding 2 units to the revised ordinate at Station 38 (53—15) and 1 unit at Station 37 (53—16), we make the two columns referred to come out zero. Of course, the same principle applies if the sign of the last two columns is negative.

It will be noted by reference to the curve just lined that the maximum throws are now +41 and —21; the increase is small (over the first solution), and is not really indicative of the saving in throw which can generally be accomplished by the changing of a few of the ordinates by one or two. This can be more clearly realized, perhaps, if one considers that, for example, by changing by unity the tenth ordinate of a curve 93 stations long, a change of 83 in the final half-throw is effected.

### Method of Compounding a Curve

In the following curve is demonstrated the method of changing the revised ordinates, and thus compounding the curve. It is usually convenient, and is a means of effecting a real saving in throw, to spiral between the two branches of the compound. As this is done merely by inserting a series between the branches, and as the operation is equally as simple as putting in all ordinates equal, one realizes almost immediately with what ease the operation can be performed. The task of realining a compound curve with an instrument (a transit) and at the same

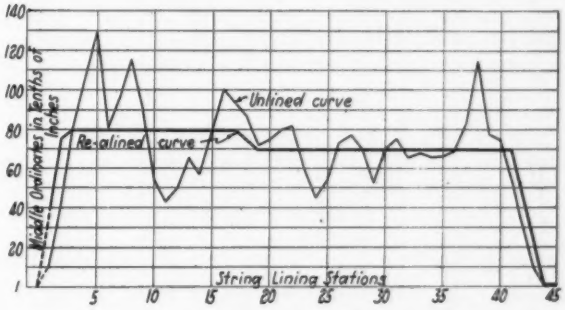



**Chart of the Ordinates of a Compound Curve**

time installing two spirals at each end and a spiral between the branches of the compound curves is one of great magnitude, as will be appreciated by anyone who has ever undertaken the task of doing this on an actual curve.

It might be well to state here that the track supervisor under whose jurisdiction this curve was, was entirely willing to throw the curve the large amounts required to install the revised curve. His reasons for so doing will doubtless be fully appreciated if the reader will glance at the accompanying graph of the original ordinates. It may truthfully be said that this curve can be considered as a "horrible example" of all that a good curve should not be, before it was realined. After the realining, which was made less troublesome than it would otherwise have been by the fact that the curve was relaid with new rail at the same time that the throws were made, this curve rode well.

In the case given below, the amount of change between the two branches of the compound was only 10 units, or 52.5 min. A very short spiral (0, 5, 10) was inserted, which suffices amply to effect the change. In general it may be said that the type and

length of the spiral between the branches of the curves is determined by the effect of the different permissible spirals on the half-throws.

In compounding a curve the exact place at which to change the revised ordinate will always have to be determined by trial. This will not require more than two trials, as a rule, if the point first selected is anywhere close to the true point of compound.

| Station Number (A) | Original Ordinate (B) | Revised Ordinate (C) | Difference Between Original and Revised Ordinates (D) | Sum of Errors to and Including Station (E) | Half Throw (F) |
|---|---|---|---|---|---|
| 1 | 11 | 38 | —27 | —27 | 0 |
| 2 | 44 | 76 | —32 | —59 | — 27 |
| 3 | 83 | 80 | 3 | —56 | — 86 |
| 4 | 109 | 80 | 29 | —27 | —142 |
| 5 | 130 | 80 | 50 | 23 | —169 |
| 6 | 81 | 80 | 1 | 24 | —146 |
| 7 | 96 | 80 | 16 | 40 | —122 |
| 8 | 116 | 80 | 36 | 76 | — 82 |
| 9 | 90 | 80 | 10 | 86 | — 6 |
| 10 | 55 | 80 | —25 | 61 | 80 |
| 11 | 43 | 80 | —37 | 24 | 141 |
| 12 | 50 | 80 | —30 | — 6 | 165 |
| 13 | 66 | 80 | —14 | —20 | 159 |
| 14 | 57 | 80 | —23 | —43 | 139 |
| 15 | 79 | 80 | — 1 | —44 | 96 |
| 16 | 101 | 80 | 21 | —23 | 52 |
| 17 | 94 | 80 | 14 | — 9 | 29 |
| 18 | 87 | 75 | 12 | 3 | 20 |
| 19 | 72 | 70 | 2 | 5 | 23 |
| 20 | 75 | 70 | 5 | 10 | 28 |
| 21 | 80 | 70 | 10 | 20 | 38 |
| 22 | 82 | 70 | 12 | 32 | 58 |
| 23 | 60 | 70 | —10 | 22 | 90 |
| 24 | 45 | 70 | —25 | — 3 | 112 |
| 25 | 54 | 70 | —16 | —19 | 109 |
| 26 | 74 | 74 | 4 | —15 | 90 |
| 27 | 78 | 70 | 8 | — 7 | 75 |
| 28 | 71 | 70 | 1 | — 6 | 68 |
| 29 | 53 | 70 | —17 | —23 | 62 |
| 30 | 71 | 70 | 1 | —22 | 39 |
| 31 | 76 | 70 | 6 | —16 | 17 |
| 32 | 66 | 70 | — 4 | —20 | 1 |
| 33 | 68 | 70 | — 2 | —22 | — 19 |
| 34 | 66 | 70 | — 4 | —26 | — 41 |
| 35 | 67 | 70 | — 3 | —29 | — 67 |
| 36 | 69 | 70 | — 1 | —30 | — 96 |
| 37 | 83 | 70 | 13 | —17 | —126 |
| 38 | 116 | 70 | 46 | 29 | —143 |
| 39 | 78 | 70 | 8 | 37 | —114 |
| 40 | 75 | 70 | 5 | 42 | — 77 |
| 41 | 55 | 70 | —15 | 27 | — 35 |
| 42 | 31 | 47 | —16 | 11 | — 8 |
| 43 | 10 | 23 | —13 | — 2 | 3 |
| 44 | 1 | 0 | 1 | — 1 | 1 |
| 45 | 1 | 0 | 1 | 0 | 0 |

Note: Ordinate of 11 units at Station 1 because Station 1 is at point of reverse curve, the next station on the other side being on the reverse curve.

### Spirals for Operation at a Fixed Speed

In order to install a spiral which can be run over by trains operating at a certain schedule speed, it is necessary to find a relation between the spiral series and that speed. It can be proved that such a relation can be readily derived. The relation is based on the results of tests made by the American Railway Engineering Association, as given in its bulletin No. 108 for February, 1911. In this bulletin it is stated that the maximum rate at which superelevation can be attained without discomfort to passengers is about 1 1/6 in. per second. From this fact, we derive a relation to the effect that the operating speed of a string lining spiral, in miles per hour, is given by

$$V=\frac{75.65}{\sqrt[3]{F}}$$

where V is the velocity in miles per hour and F is the factor of the string lining spiral to be used. This relation may be more conveniently written as

$F=432{,}975/V^3$ or, accurately enough,
$F=433{,}000/V^3$

Suppose, for example, that it is required to install a spiral which can be operated by trains running at a fixed maximum schedule speed of 50 miles per hour. Substituting 50 for V in the above equation, we have $F=433{,}000/125{,}000=3.464$. Thus, for such a case a 3.5 spiral can be used—either of the two following:

(a) 0, 3, 7, 10, 14, 17, 21, 24, 28, etc. or
(b) 0, 4, 7, 11, 14, 18, 21, 25, 28, etc.

Having written this spiral down on the slate upon which have been transcribed the ordinates of the actual curve, we proceed to line the actual curve as was done in the foregoing cases, correcting the revised ordinates and making them the proper value.

### Discussion of the Spiral

A word should be said here about the properties of the string lining spiral. It can be definitely shown that, for a given circular curve, and a given speed, there is only one transit spiral which can be used in realining a track. If other spirals are tried, one must of necessity change the degree of the circular curve slightly, or else change the direction of the tangent track line, or (as is most frequently done) compound the circular curve a short distance ahead of the point of spiral to curve.

The same thing can be done with the string line spiral, and is done, as we saw in lining the curve shown in the preceding article. Moreover, the variety of spirals which can be used in string lining far exceeds that which is available in transit lining, because of the fact that a change of only one ordinate of a revised curve in effect makes that revised curve an entirely different curve than if the change had not been made, and, inasmuch as in most curves upon which string lining computations are made there are numbers of such changes, no matter how slight or how short (in length), a number of different spirals is admissible; a fact which may at first seem contradictory of actual conditions.

For the same reason, different spirals can be used on the two ends of the same revised circular curve; in fact, the operator will generally find it a means of effecting a considerable saving in throw to use different spirals on the two ends, because of the condition of the actual track. This brings up the question of the relation of spirals to the circular curve, to the track in general, to traffic and the direction of preponderance of traffic, and to the grade line.

### Relation of Spirals to Grade Lines and to Direction of Traffic

On double or multiple track roads it will almost always be found that the spiral on the entering end of the curve—that is, at the north end of a southbound track, etc.—is appreciably longer than the spiral on the leaving end. This is as might be expected, if one analyzes the causes for such a condition. Consequently, it is generally the case that the spiral on the entering end of the *revised* curve must be longer than the spiral on the leaving end. This means that the factor of the spiral on this end must be lower than the factor of the spiral on the other end.

Because of the ease with which it is possible to line a curve on paper by this method, it is practicable to take into account the grade line in conjunction

with realining curves. This is a feature of realining to which practically no attention is ever paid, but which merits consideration because of its influence on the riding qualities of the curve and even on the safety of the curve.

For example, if a curve happens to be situated so that the leaving end is at or near the point of intersection of an ascending grade with a level grade or a descending grade (in other words, if the grade line appears in the form of an inverted V), it is practical to make the spiral to the curve at that end shorter and sharper than it would otherwise be. The train loses a great deal of its momentum and speed by the time it has reached the top of the grade (especially on ruling and maximum grades), which makes the value of V less in the formula given above and consequently, makes for a higher value of F, the spiral factor. On the other hand, when a descending grade meets another descending grade or a level grade (such that the grade line appears as an upright letter V) a long spiral is desirable. This is especially true if the grade line (on the descending grade) is such that the locomotive engineman will apply his train brakes, because a short spiral on the leaving end of such a grade, combined with the higher superelevation required by such a shorter and sharper spiral, tends to emphasize the tendency of the train to "ride" the low rail to an undesirable or even unsafe amount. This may or may not result in a derailment but is practically certain to result in throwing the spiral out of line and making for generally bad alinement throughout that entire portion of the curve.

### Start at Entering End

In connection with the making of some spirals longer than others it has been the author's experience that it is quite easy to make a long spiral on that end of the curve upon which calculations are first begun, but more difficult on the other end. Consequently, it is usually a good practice to start lining (on paper, of course) all curves from the entering end of the curve, or *with* the direction of traffic. In this way, the proper spiral is secured almost automatically. In order to do this the ordinates of the original curve should preferably be taken in the field with this end in view, so that they will not have to be written backwards when they are put on the slate. This will obviate any confusion which might arise as to which end of the curve is which, and whether the throws are written opposite the right stations or whether they have been wrongly written opposite the stations in reverse order.

## Bulletins With a "Punch"

THE purpose of issuing bulletins to foremen and others engaged in maintenance work is either to impart some definite instructions to these employees or to make them consider how they may better serve their employers and themselves in their daily work. In either case the message the bulletin conveys is of importance but the language chosen to carry the thought is of equal importance.

That bulletins of the second of the two classes referred to may be worded so as to command instant attention is evidenced by copies of two such bulletins which are issued monthly on the Northern division of the St. Louis-San Francisco and mailed to all section foremen and section men on that division and which are said to have done much to awaken interest in their work among these men with a consequent improvement of the morale of the organization. It will be noted that they have a "punch," but one that is similar to those delivered in a friendly boxing match rather than the kind that is designed to injure the recipient.

These bulletins convey no new thoughts, perhaps, but they present old thoughts in a way which cannot fail to impress the men to whom they are sent and it is easy to believe that they have resulted in an improvement in maintenance work.

NORTHERN DIVISION TRACK BULLETIN #26.

Did you ever have a hard spell of sickness and live on shadow soup and bird seed until the fever left you? Remember how good everything tasted when they began to feed you something besides fresh air and scenery? Remember what a kick you got out of each new stunt you were able to do as the strength got back into your arms and legs? It was lots more fun getting well than it was to be fully restored to health, wasn't it?

We could get the same fun out of fixing up our railroad if we were wise enough to take advantage of our conditions. We all look forward to the time when our section or our division will be up in first class condition, but the most pleasure comes with seeing it improve from day to day; from scheming to get the things done that are hard to work out. There is a lot more pleasure in getting a pinch hit with regularity than there is in sitting around a hot stove, after the close of the season, gloating over our batting average.

We all do more or less crabbing because the allowance is small or because it is not possible to do this or that. If we are going to let a small allowance interfere with our efficiency or cause us to lose our punch we might just as well call in the undertaker because he will be the only fellow to whom we will be of any benefit.

A small allowance should be all the more incentive for us to put on our thinking cap and try to figure out a way to make a monkey of the fellow who thinks we can't improve our conditions now that the force is cut down so low, etc., etc.

Anyway, we are not responsible for the dollar that was not given us; the only thing we should be concerned about is the dollar we have and what we can make it do.

This whole business of keeping up a railroad is a game of wits. We match our wits against the weather, against the forces of nature, against our superiors who assume that with the handicaps we have we can't do as much in the way of improvement this month as we did last; against our fellow foremen who have an idea they can turn out just a little more work than we can, and against our previous record is an attempt to beat it.

You would be surprised to ride over the railroad, and see how much some foremen are doing with a little of nothing; and unfortunately, you would be surprised to see how little some other fellows are doing with what they have and a splendid opportunity. Believe you me, the boys who are having the big fun are those who are making their dollars turn hand springs, and not the fellows who have hid their dollars away in a napkin because they were not born golden assles.

March 1st, 1928

NORTHERN DIVISION TRACK BULLETIN #28

A good section foreman is a man who can and will, with three or four men, properly maintain a piece of track that anyone can keep up with six or eight men. Notice that the text says "will." Some foremen have the ability but do not use it. It does not make much difference how much a fellow knows if he does not use his knowledge. There are lots of good men on the tramp today because they haven't the back bone to stay on a job or because they haven't self-control enough to get along with their supervisors or for some other equally important reason that keeps them from applying the knowledge they have.

Anyone can do a job after a fashion if given enough means. A foreman may be successful on a railroad where he has plenty of men and material, but a failure elsewhere, where these things are not so plentiful. Some fellows that are reasonably good foremen on a main line are lost when put on a branch where lots of scheming is required to get by. The woods are full of men out of a job, who call themselves foremen and who could probably qualify as such if they were put in charge of one of the six- or eight-man gangs on a three- or four-man job.

But you say, "Suppose a fellow does his best, then what?" Sometimes our best is not good enough, in which case we are either going to have to beat our best or give someone else a chance to beat it.

There is some question as to whether any of us is doing his best. Remember when you first took your present job, how many mistakes you made and how little you accomplished? You still wonder how you got by, don't you? And still you thought at that time that you were doing your best.

Why is your best today better than your best of a few years ago? Because you have learned something in the meantime and are using what you have learned. Why do some men learn more readily than others? Partly because one man has more natural ability than another; on the other hand, a good deal of this superiority is the result of one man trying harder, having his mind on his business more and not being satisfied to rock along any old way to get by.

We are judged nowdays not so much by our previous record as by a record that someone else has set up. We may be doing better work today than we were a year ago, but if someone else is doing a lot better, what we are doing does not show up well. Competition these days is mighty keen in every walk of life; if we hold our place in the game it is up to us to see that the other fellow doesn't outstrip us or beat our performance.

April 1st, 1928

**Bulletins Like These Make One Sit Up and Take Notice**

# Burlington Adopts Electric Tools

## Standardized Units Consist of Cut-off Saw, Wood Boring Machine and Hand Saw, with Portable Generator Set

As A result of studies, supplemented by tests which showed conclusively that economies in timber bridge work may be effected by the use of electrically driven tools, the Chicago, Burlington & Quincy has decided upon a standard assembly of such tools, with a portable generator to furnish the current. Each of these units consists of a reversible electric wood boring machine capable of drilling 1-in. and 1½-in. holes in ordinary grades of timber up to a thickness of 30 in., and two saws, one, a portable cross-cut sawing machine and the other, a hand saw, together with an electric generator driven by a direct connected gasoline engine. The generator furnishes 220-volt, 3-phase, 60-cycle current and the tools are provided with motors using current of these characteristics. The power unit is capable of delivering five kilowatts at a power factor of 70 per cent, which permits the simultaneous operation of one cut-off saw, two wood boring machines and one hand saw with an ample margin.

To determine the efficiency of these tools, tests were made on actual construction work where power from adjacent transmission lines could be obtained easily, those for the cut-off saw and the wood boring machine being conducted on a pile bridge being built over the Platte river, near Sterling, Colo., and those for the electric hand saw on the Canal street viaduct at Chicago. The Platte River bridge is a pile trestle consisting of 47 bents of 6 piles each, having 46 spans each 20 ft. long, with three 9-in. by 24-in. stringers under each rail, or a total of 276 stringers.

### Tests Showed Marked Saving in Labor

In the tests with the cut-off saw eight old oak piles were cut off in 16 min.; six treated cypress piles were cut off in 15 min., and six treated cypress piles in one bent were cut off in from 7 to 8 min. In this latter test it was found that the straight edge, which was of 1-in. material, was cut down on its upper face to a depth of from 3/16 in. to ¼ in., but that with the use of a heavier 2-in. by 4-in. straight edge, and care in the handling of the saw, no trouble need be anticipated on this account. The cut-off saw was also used for cutting off the ends of twelve 9-in. by 24-in. stringers and accomplished this work accurately in 20 min. As compared with hand work, the cut-off saw effected an actual saving of 62 min. to the bent in cutting off piles and of 12 min. to each stringer where both ends were cut. Since both the power saw and the hand operated cross-cut saw requires two men, this would have amounted to a saving of 206 man-hours on this bridge if all of this work had been done by the power saw.

Tests with the electric wood boring machine were made by drilling 13/16-in. holes through piles and 4-in. sway braces, the time required to bore through a 15-in. treated cypress pile and a sway brace by machine being one minute, as compared with 5 min. 20 sec. when the work was done by hand. Tests on boring the same size holes through three stringers, or 27 in. of wood, showed that with the machine the holes were bored in 1 min. 5 sec., while it required 5 min. 40 sec. to bore similar holes by hand. The tests also demonstrated that the electric borer made a straighter hole. The average saving for each hole amounted to 4.36 min., and this would have amounted to a saving of 88 man-hours if all the holes on this bridge had been bored by the electric machine.

The electric hand saw was used in cutting plank on the Canal Street viaduct at Chicago and demonstrated marked savings, especially in situations where it would be difficult to use the ordinary hand saw. While it was impossible to make an accurate comparison between the two methods, owing to the character of the work performed, it was plainly evident that the savings effected by the electric saw would amply justify the investment.

### Units Are Standardized

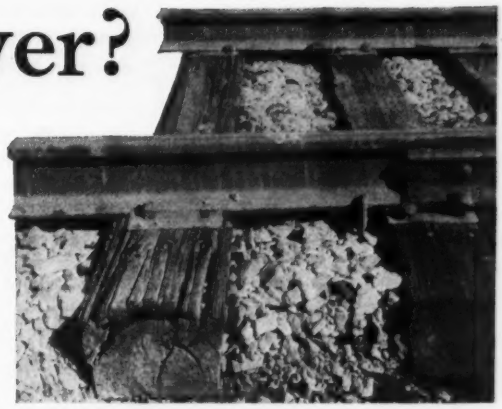
In assembling these units special attention has been given to standardization in order to keep the necessary stock of replacements at a minimum and to allow substitution of parts from similar outfits in cases of emergency. Efforts have also been made to keep down the weights of the various tools so that they may be handled easily by the men, and thus provide tools which will permit the work to be done without too great bodily effort, which in itself adds greatly to the efficiency of machine work.

The selection of a 220-volt, 3-phase, 60-cycle generator was made because that current is now in general use in lighting circuits, thus permitting the use of the tools in certain localities and under certain conditions with the generator set. The generator is provided with four standard plug connections so that the lines for the different tools can be plugged in direct, eliminating the necessity of fuses and permitting the disconnecting of any individual tool at will. The supply lines are four-conductor, rubber covered, flexible cables in 50-ft. lengths, fitted with standard plug connections. A total of 800 lin. ft. of cable is supplied for each unit to permit the operation of four tools at the same time to a distance of 200 ft. on each side of the generator. The generator has a moderate speed, from 1,200 to 1,800 r. p. m., to keep down vibration, and weighs approximately 700 lb. It is mounted on wooden skids with handles to permit its being moved either by men or by means of a derrick or some other form of hoist.

Aside from the savings effected by these units in routine bridge work they are of great value in emergencies due to washouts or other causes which necessitate the hurried installation of temporary bridges, since in such cases the time required for cutting off the piles is usually the limiting factor in the progress of the work. The generator can also be used to furnish current for electric lights for emergency work at night where other satisfactory lighting facilities are not available.

The preliminary studies which led to the adoption of these units were conducted under the direction of G. A. Haggander, bridge engineer of the Burlington, and the tests were made by F. H. Cramer, assistant bridge engineer.

# What's the Answer?



***What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities***

**QUESTIONS TO BE ANSWERED IN THE AUGUST ISSUE**

1. *When applying new joint bars in connection with the building up of battered rail ends by the welding process, should the new bars be applied before or after the welding is done?*
2. *What are the relative merits of clamshell and orange peel buckets for bridge work involving both excavation and the handling of materials such as sand or crushed stone?*
3. *At what points is corrosion most severe on rails exposed to brine drippings? Under what conditions does this warrant special inspection?*
4. *What are the relative merits of the different types of coping for brick walls?*
5. *When washed gravel is used for ballast, what should be the percentage of sand and the maximum size of the pebbles? What reasons lead to these conclusions?*
6. *What is the steepest allowable grade for various types of pipe culverts carrying water from steep hillsides?*
7. *When making high lifts on ballast what should be maximum rate of run off to be left at the end of the day's work?*
8. *Is it practicable to keep a complete list of the water service repair parts carried at various points so that they may be available for other points in cases of emergency? Where should such a list be kept?*

## Hand Pumps for Small Stations

*What are the relative merits of force pumps and ordinary hand lift pumps where the water supply for small stations is obtained from shallow wells?*

### Force Pumps Provide More Varied Service

By J. P. Hanley

Water Service Supervisor, Illinois Central, Chicago

There are many dug wells on railroads in rural districts varying in depth from 20 to 40 ft. from which water supply is obtained for section houses, depots and stock yards. Such wells are usually equipped with hand-operated pumps of the type generally known as pitcher spout, lift, force, and double acting force pumps.

Where the water requirements are small and where no necessity exists for supplying the water under pressure, the lift pump is cheaper and simpler than the force pump and should be used. There are, however, many instances where single or double acting force pumps are more desirable, some of which are as follows:

1. Force pumps will supply water on the second floors or roofs of two-story buildings for scrubbing or fire protection.
2. They can be used to wash windows, sprinkle lawns and gardens, fill hot water heating systems, wash ice and to clean warehouses and cars.
3. They will supply individual pens in larger sized stock yards from one pump by valving the discharge to suit and can also be used for watering stock in cars during transit.
4. Force pumps are usually equipped with a hose connection on the spout for ¾-in. or 1-in. hose, and also a 1½-in. or 2-in. hose pipe connection with a valve between the connections. This allows the hose to be used for temporary work and permits the pipe discharge to be installed for more permanent requirements. The pipe connection may be made either above or below the ground as climatic conditions require.
5. The double-acting pump discharges water on both the up and down stroke, gives a more uniform flow and can be operated with less effort than the single-acting pump of like capacity.
6. Many of the roads with large stock shipments use the single or double-acting force pumps entirely at their stock yards. These pumps are in many cases operated with windmill, small oil engine or motor-drive, with the pump handle for emergency use only.

In selecting pumps for small stations the lift pump may be used at points where water is delivered to the ground surface at the pump location, while a force pump should be used where water is required under pressure or is handled through a distribution system.

### Depends on Conditions Under Which Water Is Used

By Engineer of Water Service

The type of pump to be used for supplying water at small stations where no other supply is available depends on whether or not there is any advantage in delivering the water under pressure. For ordinary purposes, such as for drinking water, or as a supply for scrubbing the floors and washing the windows of small depots, the lift pump is satisfactory and is less expensive than the

force pump. This type of pump is also used for small stock yards with a single watering trough serving one or two pens, while the force pump is better adapted for medium sized yards with several pens, since it can be fitted with a supply pipe through which the water may be forced to the various troughs or to a small elevated tank. The force pump can be fitted with a garden hose, enabling it to be used for fire protection for low buildings or for watering lawns and flower beds in the station grounds. Where the distribution system of pipes from the force pump is at all extensive or it is necessary to operate the pump a considerable part of the time some form of mechanical power should be used.

## Unloading Dirt with Side Plows

*When plowing off dirt with a side plow for widening banks on multiple-track lines, what can be done to prevent material from falling between the tracks? What is the best method of removing such dirt?*

### Can Be Minimized, But Not Prevented

By Roadmaster

It is almost impossible to avoid spilling dirt on the space between the tracks when unloading dirt with a side plow from cars with swinging sides on double-track lines, and about all that can be done is to minimize this to as great an extent as possible. With many, or indeed most, materials it is necessary to open the doors on the side toward the other track to keep them from being forced open by the dirt which wedges between the end of the plow and the side of the car. To avoid this the dirt on that side is sometimes loaded lighter than in the rest of the car, but this reduces the loading capacity of the shovel as well as the amount hauled by the train and results in higher costs. On the other hand, the dirt which falls between the tracks must be removed by hand, and this is also expensive.

When dirt is unloaded in this manner on multiple-track lines a certain amount must be removed by hand from the ballast shoulder even when a spreader is used, and the gang doing this work can also remove that which falls between the tracks. The problem is to find the cheapest method or combination of methods with the foregoing in mind, and this will depend on the nature of the dirt being handled. Any dirt falling between the tracks should be removed promptly before it has a chance to work down into the ballast.

The difficulties due to this spilling of the dirt on the ballast has led to the introduction of side-dump cars which discharge their load outside the ballast line and thus obviate the necessity of so much work by hand. On this account such cars are coming into extensive use and are supplanting the older method of plowing off the dirt.

### Cars Must Be Equipped Properly

By W. H. Cleveland

General Track Inspector, Western Lines, Atchison, Topeka & Santa Fe, Wellington, Kan.

The use of a side plow for unloading dirt from cars for widening banks is old, and modern equipment, including air-operated dump cars, has so proved its economic value as largely to displace the old methods where extensive work is undertaken. Economy and dispatch are the essence of reconstruction work done under traffic in this period of the short work day and the high cost of labor and materials.

Of course, a certain amount of unloading is still being done with side plows, and it is important to avoid spilling dirt on the opposite side, as it is an added expense to remove this dirt and to clean the ballast on which it falls. Unloading with side plows necessitates the use of cars with wide openings to permit the free egress of the dirt, and the openings on the other side of the car must be kept firmly closed. The sides of the cars should be of sufficient height to prevent an overflow of the dirt, and this can be assisted by care in not loading the dirt flush with the top on the closed side.

As the plow is pulled through the cars it must pass over the open spaces between the car floors, and these openings will permit a serious overflow if not closed. The best method to care for this condition is to equip one end of each car with a steel apron the width of the car floor and long enough to rest on the floor of the next car when the cars are coupled, thus closing the open space and providing a continuous floor for the movement of the plow. The apron is secured to the car floor with heavy strap hinges countersunk in the floor to permit the free movement of the plow over the apron. After the cars are unloaded the aprons may be turned back when it is necessary to uncouple the cars.

The open spaces between the sides of the cars can be taken care of in much the same manner by using aprons attached to the inner side of the end posts at the same end of the car as the floor aprons. These side aprons are attached so that they will pivot, permitting the free end to be raised and turned back into the car when not in use. If the cars are thus properly equipped and carefully operated little material will fall between the tracks. However, in working over ballasted track it is well to use a sheet of canvas between the rails to retain the light accumulation, which can then be gathered up readily with the sheet and carried over to the outside of the roadbed, but with impervious ballast or on an unballasted roadbed the sheets will not be necessary.

The equipping of the cars in this manner for side plows can be done at terminal shops without prohibitive expense, and when the cars are no longer required for this service the attachments can be removed quickly and cheaply, releasing the cars for other service.

## Use of Salt on Brick Platforms

*Does the use of salt for removing snow or ice from brick platforms have any bad effect on the bricks?*

### Salt Has No Bad Effect on Hard, Well-Burned Brick

By General Inspector of Buildings

The use of salt for removing snow and ice from platforms has no injurious effect on the physical qualities of hard, well-burned brick but it sometimes hurts the appearance of the platform by causing an unsightly white deposit on the brick. When salt is used for melting ice on platforms it usually does not accomplish this result fully unless the coating of ice is very thin, but merely softens the ice and relieves the slippery condition. For this reason, when salt is so used, the ice should be removed with a shovel or scuffle hoe as soon as it is soft enough and the platform should then be swept off thoroughly, as the softened ice furnishes a disagreeable footing and the salty water is injurious to shoes.

Other materials, such as ashes or sand, are sometimes sprinkled over the ice on platforms as a measure of safety when the ice is so firm that it cannot be removed readily with the means at hand, but these also are objectionable as soon as the ice has begun to melt. The

ashes are particularly unsatisfactory since they soil the shoes and also the floors of the station or cars into which they are carried by those using the platform. No matter what material is used to melt the ice or to remove the slipperiness it should be recognized that the job is not complete until the ice has been removed completely and that the other methods are only emergency measures.

### Does Not Injure Brick but Has Other Drawbacks

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

Chemically there should be no action between the salt and the brick, but if the bricks are porous and the salt water seeps into the surface, there is a greater tendency to wear off or chip the surface than would otherwise be the case. The wet and somewhat slippery surface made by the melting ice is always objectionable especially around the entrance to depots or other buildings. The salt carried in on the wooden floors damages the finish as well as the wood and creates a generally unsatisfactory appearance.

Salt is a poor material to remedy an icy platform condition, and the situation can usually, if not always, be handled more economically and better in every way by the use of dry, clean, sharp sand.

## Sorting Discarded Materials

*When shipping in discarded materials, should the track foreman attempt to separate scrap from usable material or should this be done at a central point?*

### Foreman Should Sort Out the Scrap

By L. L. ADAMS

Roadmaster, Louisville & Nashville, Louisville, Ky.

When released material is assembled at the section headquarters, the usable material should be sorted out from the scrap. The foreman should then use all of the good material he needs on his own section, and the supervisor, by looking over the surplus, can often use it on an adjoining or nearby section. Material that cannot be used in this way should then be sent to a central point.

In this way the double handling of material will be avoided and much of the second-hand material can be used at the point of origin. This will also permit the use of a magnet crane for handling the scrap at the central point instead of by hand, as would be the case if usable and scrap material were shipped together.

This sorting out by the foreman is also necessary in order to properly account for material on each section. If all material from a number of sections were loaded in one car and forwarded to a central point for classification it would be impossible to credit the right section with the material classified as usable.

### Should Be Done at a Central Point

By E. L. BANION

Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

The track foremen should not attempt to separate scrap from usable material, but all should be sent to a central point or reclamation plant, where a force of men trained in the salvaging of all usable or serviceable material is maintained. What would be classified as scrap by the track foreman might, after a small amount of work or repairs by the reclamation plant, be returned to service, or possibly just the opposite of this would be the case. Therefore, the classifying of all discarded material should be placed in the hands of men who are trained and qualified to make this classification.

### Ship the Material to a Reclamation Plant

By L. J. DRUMELLER

Assistant Division Engineer, Chesapeake & Ohio, Russell, Ky.

All released material should be loaded and shipped to a central point, where the classification should be made. The plan of having each foreman separate his own scrap has not proved satisfactory, as it is hard to get any two men to decide alike as to what is scrap and what should be reclaimed.

On our road all material is shipped to the reclamation plant and sorted at that place, which means that the separation of the scrap from usable material is done under one supervisor, and this arrangement has proved extremely satisfactory.

## Curve Superelevation on Bridges

*What is the best method of providing superelevation of the track on bridges on curves?*

### Different Structures Require Different Methods

By J. S. HUNTOON

Assistant Bridge Engineer, Michigan Central, Detroit, Mich.

The best method of providing superelevation of track on bridges constructed on curves requires a study of conditions such as the speed of trains, the type of structure and also whether the tracks are operated as yard or main tracks. The structure should be so designed as not to require a large number of ties to be framed in a complicated manner, as this is not only expensive but requires considerable supervision to attain the desired results.

Superelevation of the outer rail on ballast floor structures is comparatively simple, as the track can be ballasted to give necessary elevation in the same manner as curves are surfaced on the roadbed. A desirable method of taking care of the curve elevation in pile trestles is to use two caps on each bent and to place packing blocks of varying thickness between the caps, the packing blocks on the outside of the curve being thicker than those near the inside rail. There are a number of ways of taking care of the elevation in plate girders. A method sometimes used is to make the castings on the outside of the curve deeper to give the desired elevation. This method permits the ties to be sized uniformly on the same flange plates.

A more desirable method to obtain the proper elevation is to frame the ties with more of a dap on the inside girder so as to give the proper inclination. Another plan is to place a longitudinal strip on the top flange of the outside girder under the ties, the thickness of which is the amount of elevation. This arrangement permits the ties to be framed alike. There is some objection to this method, as the longitudinal strip is liable to become loose if not properly bolted to the girders.

### Depends on Type of Bridge and Amount of Elevation

By F. H. CRAMER

Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Careful study should be made of the deck and other features of the floor system as well as the amount of superelevation of the outer rail on a bridge on a curve.

On ballasted decks where the regular track ties with the ordinary spacing are generally used the best method

of providing superelevation is to place it all in the ballast; and should the ballast requirements be excessive, the deck should be designed to take a portion of the superelevation.

For open decks on steel bridges various sizes of ties are used, and where the dapping is considerable, special consideration must be given to their design. Several methods are used, and the most common one of these is to keep the girder or stringers at the same elevation and to use ties of constant depth with a different dap at each end, but this method becomes expensive where excessive superelevation is required. In my opinion, the best method of providing superelevation is to use a given depth of tie up to a certain degree of curve (about two degrees), thus allowing a constant depth for maximum moment with light dapping. On curves of a greater degree where the superelevation is excessive it is best to use a constant depth of ties and attach beveled shims under the higher ends. These should be securely fastened to the ties and should have sufficient depth over the girders or stringers to prevent them from breaking down under loads.

For open decks on pile trestle bridges the best method is to place all the superelevation in the bents. This should be done in the cut off of piles or of the posts in frame bents.

### Method Adopted Should Permit Change

By Division Engineer

In providing for the superelevation of the track on bridges on curves, two general methods are in use. In the first the substructure is so designed as to provide the desired inclination of the superstructure, while in the second the substructure is constructed to provide a level surface and the inclination of the track is secured either by framing the ties or by the use of blocking or other supports for the ties.

An example of the first method is found in timber trestles where the piles are cut off or the posts framed so as to give the cap the desired slope. For comparatively short steel spans, usually of the girder type, the inclination is sometimes provided by the use of pedestals of different height or, more rarely, by providing for this by making the inclination in the bridge seats of the piers and abutments.

If it is reasonably certain that it will never be necessary to change the superelevation of the track this method has its advantages, since it imposes little, if any, extra work in the erection of the substructure, while it eliminates any special framing of the ties or of other timbers which would be necessary under the second method. But often it becomes desirable to change the superelevation on account of changes in the requirements of traffic, and when this occurs the advantages secured by the first method are immediately nullified and the procedure then becomes the same as if the substructure had been built in accordance with the second method.

In the second method the inclination of the deck on pile trestles is sometimes made by the use of two caps, the lower one level, while the second is inclined by placing it on blocks of varying thickness spiked to the lower cap. This method involves a considerable amount of timber for the extra cap and also an increase in the labor necessary to place the blocking and extra cap. Another method, which is more economical in the use of timber but which also requires considerable labor, is to frame a tapering timber the width of the cap and to spike it to the cap to receive the stringers. The elevation is sometimes obtained by the use of blocks or shims under the rail on each tie. When the timber is untreated these blocks or timbers provide additional places for water to find its way between the faces of adjacent timbers to start decay.

On deck girder bridges a simple method is to bolt a longitudinal timber of the proper thickness to the top of the outside girder. In other cases the ties are dapped to give them the proper inclination, and, although this involves considerable extra labor and also an increase in the amount of timber for the ties, it is often preferred, as it obviates the use of blocks or extra timbers which may require more frequent renewal than the ties.

It will thus be seen that the question of providing superelevation on bridges is intimately connected with both design and maintenance and that the decision as to methods must take both of these into account, as well as the possibility of having to provide subsequently for a different rate of superelevation than the one adopted originally.

In providing for high superelevation of the track by inclining the ties the elevation of the surfaces of the inner ends of the ties on sharp curves must be varied to afford a uniform rate of grade for the inner rail, while the inclination of the ties remains the same throughout. The center line of the girder being straight, while the track is curved, it is usual to place the girder so that the center line of the track will be at equal distances from the center line of the girder at the center and the ends, falling outside at the center and inside at the ends.

In the case of a six-degree curve on a 70-ft. girder, the middle ordinate of the track on the span is eight inches, consequently the inner rail at the ends of the span will be eight inches nearer the ends of the ties than it is at the center of the girder. Assuming that the track has a superelevation of seven inches, the inclination of the ties will be 7 in. in 56½ in., or 1 in. in 8 in., for all practical purposes. Consequently, if the inner ends of the ties are placed at the same grade from one end of the span to the other there will be an actual rise of one inch in the grade of the track from the ends to the center of the girder. For smaller superelevations and lighter curves this can be disregarded, the extent to which it is to be taken into account varying with the degree of refinement desired.

## Removing Piles from Under Water

*What is the best method of removing old piles standing in water when it is impracticable to pull them?*

### Can Be Removed with Dynamite

By G. A. Haggander

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Several years ago we had occasion to remove some white oak piles and desired to cut them off several feet below low water. Our first thought was to bore a vertical hole in the center of the pile, charge it with dynamite and shatter the pile, but our attempts along this line did nothing but split the piles. We then consulted an expert on explosives, who advised that we string sticks of dynamite on a heavy wire and sink this around the piles to the bottom of the stream. We tried this, and when the charge was set off the piles were cut off as desired. This method is not generally used, however, whenever piles can be pulled. It requires from four to six sticks of dynamite, depending on the kind of timber to be broken off. Occasionally the piles are broken off at the stream bed by making a hitch on the

top and pulling them sideways until they break. The break is usually at the ground line or slightly below it.

### Can Often Be Done Cheaper by Contract

By Bridge Engineer

Piles which must be removed from water where it is impracticable to pull them with the means available may sometimes be cut off at the desired elevation by boring a hole in the center of the pile to the proper depth and inserting a stick of 60 per cent dynamite, which when exploded will usually cut off the pile. Where the wood is particularly tough this method is not always effective and a dynamite of less than 60 per cent strength will rarely cut off the pile, but will only split it.

The removal of piles from water under bridges is often hard to accomplish, especially when they must be cleared from a space to be used as a channel for boats, and unless the railroad is supplied with special equipment for this class of work it is usually cheaper to have it done by contract by some firm specializing in dock and harbor work, if such a firm can be found within a reasonable distance from the job, since such firms are fitted out with the requisite men and equipment, such as divers or saws for cutting off the piles under water.

In ordinary streams under fixed spans all that is necessary in most cases is to wait until a low stage of water occurs and then to cut off the piles at the water level.

## Runways for Motor Car Set-Offs

*Should runways between the rails and adjacent to the track be provided at motor car or hand car set-offs? If so, should they extend across both tracks of double-track lines? What form of runways is best for this purpose?*

### Should Be Provided as a Safety Measure

By C. W. Baldridge

Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

By the term "runways" we are assuming that it means any kind of fill or of timbering which will facilitate the removal of a motor car or hand car from the track and placing it out of the way of passing trains. When motor cars were unknown and hand cars, push cars, and perhaps a few velocipede cars were all that were used, the construction of hand car set-offs was practically unknown. In those days such cars were light enough so that the gangs using them practically always consisted of enough men to remove the car from the track readily at any desired point. With the advent of the heavier motor cars, particularly due to the fact that these cars are frequently used by fewer men than formerly used the hand car, it became advisable to build set-offs at convenient intervals along the track.

A hand car set-off should be built so that its surface will be about one inch, or at most two inches, lower than the top of the rail. Bearing in mind that many motor cars are being used every day, and that in many cases it is imperative that a motor car be removed from the track quickly, the importance of making such removal convenient is apparent. For this reason, the track should be filled in with ballast between the rails to as near the level of the rails as is practicable. Wherever the snow fall is of sufficient amount to make it necessary to use snow flangers to keep the track open for traffic, the distance between the top of the fill and the top of the rails will be governed by the depth below top of the rails reached by the flanger blades. Other than this, the filling between the rails should be about the same height as the top of the hand car set-off.

On double track, a runway should be built between the tracks, and both tracks should be filled in to permit cars to be placed on the set-off from either track and also to permit cars to be changed from one track to the other. As to the form of runway most suitable—runways built of planks or other sawed lumber are most easily built, but such construction is expensive and has other drawbacks which make runways of ballast more economical and less troublesome.

The hand car set-off should be made by fill, or where cuts are very long, by excavation to the level of subgrade. Sufficient ballast should then be added to permit a solid flooring to be made of old ties, and placed upon such ballast to the desired level below the top of the rail. The flooring should begin next to the rail and extend outward the full width of the set-off, and a supporting shoulder of ballast should extend around the other sides of the flooring.

Between the rails and between tracks, the runway should be made entirely of ballast, compacted as much as may be found necessary. The use of plank between the rails introduces the danger of the planks being forced up by snow being crowded under them, just as sometimes happens with plank crossings. Planks also make necessary the spiking into the ties with the damage thereto occasioned by the frequent removal and replacing of the planking when surfacing or spotting track. Runways made of ballast can be shoveled out when necessary to work the track and can then be replaced with no loss except the labor of handling.

Failure to provide runways between the rails and between the tracks at set-offs increases the danger of a car being struck by a train owing to the possibility of its getting jammed between the rails or caught on a rail while being removed and also introduces a risk of damage to a motor car engine or transmission, while the car is being dragged over a rail. Those who use motor cars know how often one gets fingers pinched while trying to ease a car over the rail while putting it on or off the track. Under present day methods of railroading, runways between the rails and between tracks would seem to be just as necessary as are the car set-offs.

## Large Pieces of Stone in Gravel

*When using bank-run gravel what is the best method of disposing of stones too large for ballast?*

### Handling Such Material Is Expensive

By H. R. Clarke

General Inspector Permanent Way, Chicago, Burlington & Quincy, Chicago

Stones too large for ballast are a source of considerable expense to the track forces when they occur in any quantities in the gravel unloaded along the track, since they cannot be placed in the track where only light lifts are made and often there is no convenient place to dispose of them, while they detract from the appearance of the track and right-of-way unless they are taken care of.

A considerable amount of these stones may be buried in the ballast shoulder, taking care to place them low enough so that they will not interfere with the removal of the ties. They may also be used to advantage in filling gullies which may have started to wash in the sides of fills and in some cases they are used to build hand car or motor car set-offs. In other cases they are sometimes spread over unpaved highways crossing the track at

grade, a covering of earth being placed over them to form a surface for the road. Any that cannot be used in these ways should be buried in the sides of the embankments.

All of these methods involve considerable work and usually are not economical in themselves, aside from the necessity of getting rid of the stones on account of appearances. For this reason, when the available gravel contains a large proportion of this kind of material and large quantities are loaded, consideration should be given to screening it out at the pit, where it can be crushed. This, of course, will add to the cost of the ballast, but will be less than the cost of handling the large material along the track, although the cost of screening will appear to be greater on account of being concentrated at one point, while the costs of handling the unscreened gravel are not seen so readily. The large pieces are valueless as ballast, consequently they add to the cost of hauling and, after they are unloaded, add still further to the cost of handling.

### May Be Used In Various Ways

By Roadmaster

The disposition of pieces of gravel too large to be used as ballast depends to a great extent on the amount and size of the pieces and it is assumed that the question refers to the ordinary maintenance of ballasted track where only small lifts are made. On heavy lifts there is no objection to the presence of the larger pieces in the lower part of the ballast but care should be taken to keep them low enough to allow a bed of finer gravel under the entire lower surface of the ties.

Where such pieces constitute a considerable part of the ballast unloaded along the track they should be thrown aside while the ballasting is in progress and disposed of as soon as the ballasting is completed, when they can be collected or used as riprap at places where the embankments are subject to wash, in ditches or at the ends of culverts, while the smaller pieces are often used to form a curb to maintain the toe line of the ballast. They may also be placed around telegraph poles or roadway signs, in a circle from 18 to 24 in. in diameter, not only improving the appearance of the right of way but also preventing the growth of grass and weeds around these facilities, which induce decay while green and form a fire hazard when dry. In extreme cases it may be desirable to load the pieces by work train to be used elsewhere as riprap. They should never be left scattered on the shoulder of the roadbed, as they present a very unsightly appearance when this is done.

Where the gravel in its natural state contains a large percentage of material so coarse that it cannot be used satisfactorily as ballast, it is sometimes screened at the pit and the larger pieces crushed and loaded as ballast, this method proving economical in relieving the track forces of the necessity of disposing of the coarse material which makes good ballast when crushed.

**The Making of a Tie**

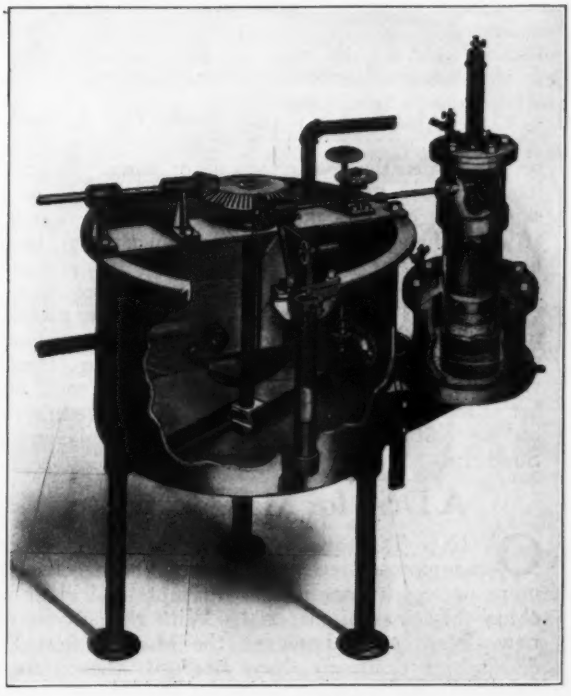
A tie hacking contest was a feature at the recent Tie Producers' convention at Hot Springs, Ark., as pictured above. Upper left: Blocking the log; Upper right and lower left: Slabbing the log, and lower right: Squaring the tie with a broadaxe.

# New and Improved Devices

## A Venturi Type Water Softener

A WATER treating plant, in which the principle of the Venturi meter is being employed for proportioning chemicals to the rate of flow of the water being softened, has been developed by the American Water Softener Company, Philadelphia, Pa. It is also designed to provide a convenient means of adjusting the proportion of chemicals to the degree of hardness of the water.

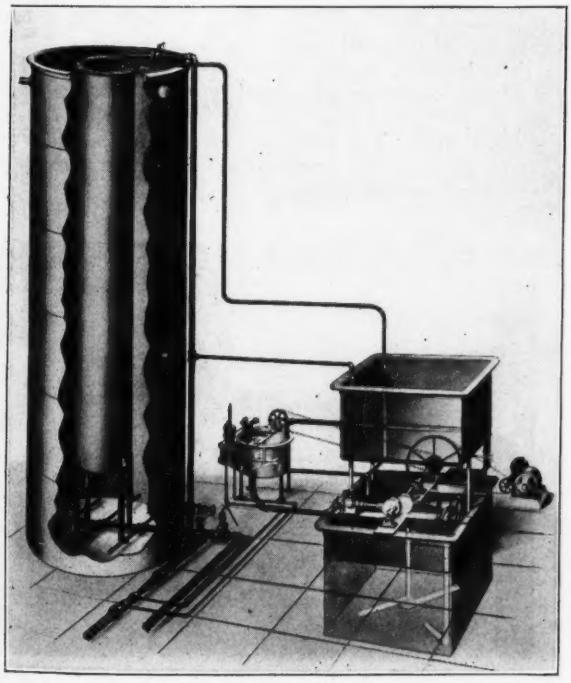
The general view shows the treating tank on the left to which the untreated water is fed by a supply pipe fitted with a Venturi tube. On the right are two rectangular tanks, one above the other, the upper being used for dissolving the chemicals and the lower for holding the charge. In the center is a smaller cylindrical tank with an orifice at one side by means of which the flow of chemical is proportioned both to the flow of the untreated water and its hardness. The chemical passing through this orifice is delivered to the mixing compartment of the treating tank by means of a cam-operated pump. A chemical sump is usually introduced between the orifice and the pump where the chemical is diluted if necessary to augment its flow.



Details of the Orifice Box

The proportioning for hardness is controlled by changing the size of the orifice by means of a sliding cover controlled by a rack and pinion mechanism as seen at the right side of the orifice box in the large scale view of this box. Proportioning to the rate of flow of the untreated water is determined by the height at which the solution is kept in the orifice box. During operation the chemical is in constant circulation, flowing from the mixing box into the orifice box and overflowing out of the latter through a swiveled skimmer back into the chemical supply vat, whence it is pumped back into the chemical mixing box by a second cam-operated pump.

The elevation of a skimmer in the orifice box is the critical element in the proportioning apparatus, as this determines the head on the orifice at all times. To the right of the orifice box is a two chamber cylinder containing mercury. The inner chamber is connected to the throat of the Venturi tube on the supply pipe and the outer chamber is connected to the mouth of the



General Diagram of the Plant

tube. The inner chamber is open at the bottom so that the mercury stands at the same level in both chambers when no water is passing through the Venturi tube. When water is passing through the Venturi tube the difference in the pressure between the throat and mouth of the tube causes the mercury to assume a lower level in the outer chamber and rise to a higher level in the inner chamber. This difference in mercury levels varies in exact accordance with the rate of flow through the Venturi tube.

A cast iron float is placed on the surface of the mercury in the inner chamber of the mercury tube. The stem of the float is connected by a gear to a shaft which revolves when the float moves up or down. In revolving, the shaft raises and lowers the free end of the skimmer or overflow pipe in the orifice box. The level at which the skimmer draws off chemical from the orifice box is thus directly proportioned to the rate at which untreated water is flowing in the supply line.

Advantages claimed for this system by the manufacturer are its adaptability for ground level operation of the softening process, accurate proportioning, freedom from clogging of chemical feeding and the small number of moving parts. Plants of this design are in service on the Baltimore & Ohio, the Pennsylvania and the Southern.

## A Drill for Manganese Steel

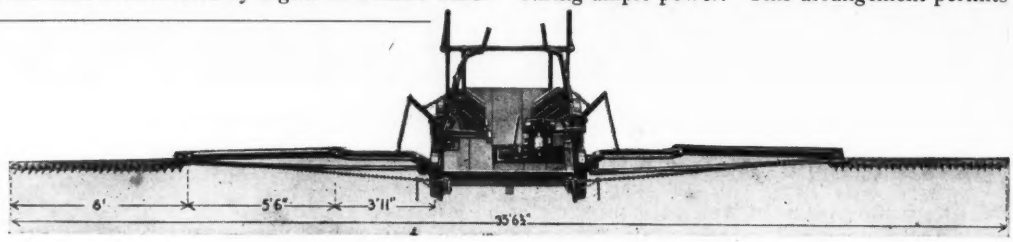
OWING TO the characteristics of high-content manganese steel, it has always been considered more or less impractical to attempt to drill or machine this class of material. With the advent of a new Cobalt steel, however, the Morse Twist Drill & Machine Company, New Bedford, Mass., has developed and is marketing drills upon specification which are said to be successful in this class of work. This claim is based upon tests carried out in the company's laboratory on railway frogs with a chemical content of 1.08 carbon, 10.04 manganese, and with a Brinnell hardness of 207 to 217.

**A Drill for Work on Manganese Steel**

The drills used were designed to withstand extreme torque and a high point pressure. In one of the tests made by the company, it was able in one grind to drill nine holes, 1½ in. deep, through a manganese steel frog with the above mentioned chemical content, a performance which is considered good in the drilling of manganese steel since the company has never been able to approach this performance with regular high-speed steel drills.

## A Motor-Driven Track Mower

TO REDUCE the cost of mowing vegetation along the track and roadbed and also to increase the speed with which this work can be done the Rawls Manufacturing Company, Streator, Ill., has developed and placed on the market a new mower which it has designated as Type B. The device consists of a trailer car on which are mounted the cutter bars, together with a gasoline engine for driving the bars. The trailer is towed by the regular section motor car, thus providing one motor for propulsion and one for mowing and assuring ample power. This arrangement permits the use of a comparatively small engine for mowing and reduces the investment, a point of considerable importance when the equipment is idle, and also provides a unit of reasonable weight which can be set off the track readily.




**Rawls Type B Track Mower with Extension Bars**

The mower will cut a swath six feet wide on each side of the track beginning at a point as close as six inches to the rail, and, by the use of extension bars, an additional swath six feet wide can be cut to an extreme width of 15 ft. 5 in. from the rail. The cutter bars can be adjusted to cut at any desired angle above or below the horizontal, the raising or lowering of the bars being accomplished by means of levers and quadrants mounted on the car. The cutter bars are attached to the operating mechanism by three wooden pins which are strong enough to withstand the strains imposed by mowing but which will break when an obstruction is encountered which cannot be cut, thus protecting the mechanism from injury. When broken, the wooden pins can be replaced easily by new ones.

The gasoline engine which operates the cutter bars is of the four-cycle, air-cooled type. The frame of the car is built up of steel channels and the wheels are of pressed steel. The axles run in steel boxes which are bolted direct to the frame of the car and are equipped with Hyatt roller bearings.

**A Special Truck is Used for Handling Motor Cars at the Missouri Pacific Repair Shop at Sedalia, Mo.**

# With the Associations

### The Maintenance of Way Club of Chicago

The last meeting of the club for the fiscal year was held at the Auditorium hotel, Chicago, on the evening of May 16, when R. W. Pritchard, western manager of the Reade Manufacturing Company, presented an interesting talk on weed killing with chemicals.

### American Wood Preservers' Association

The customary joint meeting of the committees of the American Wood Preservers' Association and the Committee on Wood Preservation of the American Railway Engineering Association will be held this year at the Chattanooga, Tenn., on June 12 and 13.

### International Track Supervisors' Club

At the last meeting of the International Track Supervisors Club, held at the Hotel Statler, Buffalo, E. Woodings, president and general manager of Woodings Forge & Tool Co., Pittsburgh, described the process used by his company in reforming worn angle bars, and the success which is attending this new practice. Other subjects discussed included the oiling of track joints, and the surfacing of stone ballast track.

### Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club, which will be its annual business meeting and outing, will be held on June 16, at Karatsonyi's Resort, Glenwood Landing, L. I. Invitations are being sent to all members, their friends and members of their families. Through the courtesy of the Long Island railroad, a special train, honoring all foreign line railroad passes, will leave the main concourse of the Pennsylvania Station, New York, at 10:30 a. m., daylight saving time, and will carry the party to the resort. Similar facilities have been arranged for the return of the party in the evening.

### American Railway Engineering Association

Although this is the time of the year when committee activities are confined primarily to meetings of subcommittees, four of the standing committees held meetings during the month of May—the Electrical Section at New York on May 8, the Masonry committee at Chicago on May 9, the Committee on Iron and Steel Structures at Cleveland on May 10 and 11, and the Track committee at Montreal on May 30. The Committee on Economies of Railway Location had a meeting scheduled for May 22, but it was later postponed. The June bulletin, which is now on the press, will contain 180 pages devoted to a monograph by Dr. Hermann Von Schrenk, consulting timber engineer, St. Louis, Mo., on the mechanical wear of ties, based on extensive investigations here and abroad.

# Shifting Load on Car Causes Bridge Failure

A PECULIAR combination of circumstances was responsible for the failure of a bridge on the St. Louis-San Francisco near Nash, Mo., on March 29, as presented in a report made by the Bureau of Safety of the Interstate Commerce Commission, dated April 30, 1928. The damage to the structure, which resulted in its failure, was caused by a shifting load on one train, but the bridge did not fail until the derailment following the first accident had been cleared up and a second train was crossing the structure.

The bridge in question was a through pin-connected truss span, 146.4 ft. in length, with a trestle approach at each end. A southbound freight train reached the bridge at 3:55 a. m. and crossed at very slow speed, owing to the fact that it included a car loaded with a tractor derrick which had been found to be swinging to an appreciable extent before the train reached the bridge. However, in spite of the fact that the train crew was making careful observations while this car moved across the bridge, a confusion of signals resulted in the derrick striking the southwest end post of the span and derailing the car upon which the derrick was loaded. The track was quickly cleared and after the bridge had been inspected by a general bridge foreman, who was unable to locate any damage other than a moderate bending of the end post that had been struck, a northbound freight train was permitted to cross the bridge and while this train was moving slowly over the span this end post bowed or buckled upward until the forked ends slipped off the pins, thereby collapsing the west truss and dropping the span and train into the opening. Testimony offered by the chief engineer and the bridge engineer of the railroad indicated that the structure was of ample strength for the loads to which it was subjected. An examination of the wreckage disclosed no evidence of defective material.

The conclusions of the Bureau of Safety offers no particular comment or criticism other than to call attention to the fact that the general foreman of bridges and buildings who examined the span after the first derailment and judged the structure safe for traffic had no technical knowledge of steel bridge work. However, it states further that it is not definitely known whether the weakened condition of the span was clearly manifest after the first accident, and of a nature so serious that its dangerous condition should have been realized and traffic suspended until proper tests of the bridge were made.

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### Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 23-25, 1928, Hotel Statler, Boston, Mass.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April, 1929.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 18-20, 1928, Book Cadillac Hotel, Detroit, Mich.

Track Supply Association.—A. H. Told, secretary, Positive Rail Anchor Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

# The Material Market

CONTINUED production of steel at a high rate during April was effective in changing a three-months' record production into a four-months' record output, the total for the first four months of 1928 equaling 16,846,729 tons as compared with the previous high record of 16,521,904 tons for the months of February, March, April and May, 1927. It is evident, however, that the output for May of this year will not equal that for April, for while production in the Chicago district continues at 95 per cent of capacity, it declined from 80 per cent to 75 per cent in the Greater Pittsburgh district during the course of the month.

Deliveries have also been large but the margin of unfilled orders has declined to a place where producers in many lines are virtually operating on current demands. This practice of ordering for immediate delivery has become so thoroughly established that it has caused no particular concern except among the producers of wire and wire products, who have had difficulty in securing sufficient business to sustain a production equal to 50 per cent of capacity. The rail mills are still turning out large tonnages. The output in the Chicago district is still at 90 per cent of capacity, and can continue at that rate for at least 30 days without an appreciable addition to the orders on the books. The track accessory plants are operating at practically full capacity and have orders that will justify maximum output for a considerably longer period. While the railroads showed some tendency earlier in the month to curtail orders for deliveries against their contracts for rails, this is not now so evident and a few roads have placed moderate supplementary orders with indications that these will continue to be placed in increasing volume.

With the ratio of demand to production such as to give rise to a decline in unfilled orders, it is to be expected that prices would be weak. However, no changes are noted on the quotations on track materials. The price for steel tie plates appear to have been established at $43 per net ton (2.15 cents per lb.) after the reduction of a month ago. Structural steel prices are

**Iron and Steel Prices Per 100 Lb.**

| | April | | May | |
|---|---|---|---|---|
| | Pittsburgh | Chicago | Pittsburgh | Chicago |
| Track spikes | $2.80 | $2.80 | $2.80 | $2.80 |
| Track bolts | 3.80 | 3.80 | 3.80 | 3.80 |
| Angle bars | 2.75 | 2.75 | 2.75 | 2.75 |
| Tie plates, steel | 2.15 | 2.15 | 2.15 | 2.15 |
| Boat spikes | 3.00 | 3.00 | 2.80 | 3.00 |
| Plain wire | 2.50 | 2.55 | 2.50 | 2.55 |
| Wire nails, keg | $2.60 to 2.65 | $2.65 to 2.70 | $2.55 to 2.65 | $2.60 to 2.70 |
| Barb wire, galv | 3.35 | 3.40 | 3.35 | 3.40 |
| C. I. pipe, 6 in. to 12 in., ton | | 36.20 to 39.20 | | 39.20 to 41.20 |
| Plates | 1.85 to 1.90 | 2.00 | 1.85 | 2.00 |
| Shapes | 1.85 to 1.90 | 1.95 to 2.00 | 1.85 | 2.00 |
| Bars, soft steel | 1.85 to 1.90 | 2.00 | 1.85 | 2.00 |
| Rivets, struc | 2.90 | 3.00 | 2.90 | 3.00 |
| Con. bars, billet | 1.90 to 2.00 | | 1.85 to 1.90 | |
| Con. bars, rail | 1.75 | 1.85 | | 1.85 to 1.95 |
| Rails per gross ton f.o.b. mills | 43.00 | 43.00 | 43.00 | 43.00 |

softer than they were last month and while the mills contend that prices on plates, shapes and bars are definitely at 1.85 cents, Pittsburgh, and 2 cents, Chicago, there is evidence that attractive tonnages are being placed at lower figures. Mills in the Chicago territory have difficulty in retaining business ordinarily assumed to be tributary to that producing center, by reason of the competition with eastern mills which have taken some tonnage at 1.95 cents, Chicago. Some of the railroads have closed contracts for structural steel bridges at prices, including erection, which indicate concessions on the part of mills to the fabricator.

Prices on wire and wire products, particularly nails, show weakness. The larger manufacturers are holding to 2.65 cents, Pittsburgh and Cleveland for nails; but a price of 2.55 cents is not unusual. Mills in the Chicago territory are maintaining the quotation of 2.70 cents with difficulty. Cast iron pipe on the other hand, has experienced an advance in price. Increases made

**Scrap Prices Per Gross Ton at Chicago**

| | April | May |
|---|---|---|
| Relaying rail (including angle bars) | $26.00 to $31.00 | $26.00 to $31.00 |
| Rails for rerolling | 13.75 to 14.25 | 14.50 to 15.00 |
| Rails less than 3 ft. long | 15.00 to 15.50 | 15.25 to 15.75 |
| Frogs and switches cut apart | 13.00 to 13.50 | 13.50 to 14.00 |
| Steel angle bars | 13.75 to 14.00 | 14.50 to 15.00 |

early in the month are apparently holding, as current quotations are now $3 higher than they were a month ago. Scrap prices are also strong, as indicated by the table appearing in this column.

The marked increase in lumber buying which has taken place during the first four months of the present year, has continued through May although it may have been stimulated artificially in the West Coast producing fields by the announcement of the mills of a plan to curtail production, notwithstanding the fact that the output of the West Coast mills has been less than sales since the first of the year. Statistics compiled by both the West Coast Lumberman's Association and the Southern Pine Association show orders in larger volume

**Southern Pine Mill Prices**

| | April | May |
|---|---|---|
| Flooring, 1x4, B and better, flat | $38.38 | $38.14 |
| Boards, 1x8, No. 1 | 32.50 | 33.68 |
| Dimension, 2x4, 16, No. 1, common | 25.47 | 25.85 |
| Dimension, 2x10, 16, No. 1, common | 26.75 | 28.57 |
| Dimension, 2x4, 16, No. 2, common | 21.75 | 21.63 |
| Dimension, 2x10, 16, No. 2, common | 22.75 | 23.36 |

**Douglas Fir Mill Prices**

| | April | May |
|---|---|---|
| Flooring, 1x4, B and better, flat | $24.25 | $23.25 |
| Boards, 1x8, No. 1 | 16.50 | 16.25 |
| Dimension, 2x4, 16, No. 1, common | 18.00 | 18.00 |
| Dimension, 2x10, 16, No. 1, common | 17.50 | 17.75 |
| Dimension, 3x3 to 4x12, No. 1 common | 19.25 | 19.25 |
| Dimension, 5x5 to 12x12, No. 1, common rough | 16.75 | 17.25 |

than for the corresponding period last year and also a considerable excess in the totals of orders as compared with either shipment or output. While prices have been subject to considerable fluctuation they continue strong and, as shown in the table in this column, declines in some items are fully offset by advances on others.

While there have been advances in the prices of Portland Cement at one or two distributing centers, no changes have taken place at the points listed below. Prices quoted are per barrel in carload lots not including package.

| | | | |
|---|---|---|---|
| New York | $2.03 | Minneapolis | $2.22 |
| Pittsburgh | 2.04 | Denver | 2.85 |
| New Orleans | 2.50 | Dallas | 2.40 |
| Chicago | 2.05 | San Francisco | 2.41 |
| Cincinnati | 2.22 | Montreal | 1.41 |

CROSSING ELIMINATION IN CANADA—The Board of Railway Commissioners of Canada has a fund of $2,631,645, for use in abolishing highway grade crossings, which, under the law establishing the fund, cannot be used for a crossing of more than four tracks, or for any crossing installed since 1909. The operation of the fund is limited by statute to the end of 1929. Charles A. Dunham, minister of railways and canals has laid before the House of Commons a proposal to modify the law so that the fund may be applied to various proposed improvements, which heretofore have been unable to derive benefit from it.

# Railway News

# Briefly Told

**Princess Elaine White Eagle,** daughter of a Ponca Indian chief, drove the golden spike which marked the completion of the line of the Chicago, Rock Island & Pacific from Billings, Okla., to Ponca City, on April 18.

**N. H. Kern, Jr., and C. W. Kern,** father and son, are section foremen on the James River division of the Chesapeake & Ohio. Last year the father won first prize for the best section and the son won second prize.

**A record of 830 days** without a reportable accident has been attained by the track forces employed on that portion of the Chicago division of the Chicago Great Western under the direction of John Farrell, the supervisor. A no-accident record for the maintenance-of-way forces of the entire division was broken after a period of 358 days without an injury to any employee.

**The O. & N. division** of the Louisville & Nashville had no reportable injuries during March and April, making a total of 14 months in which this division has had a clear record in this respect since the establishment of the safety department in 1918. The Atlanta, Knoxville, St. Louis and St. Louis Terminal divisions also passed through April with no reportable injuries.

**The National Safety Council,** at a dinner held in Chicago on May 21, awarded bronze plaques to the seven roads which made the best accident prevention records during 1927, based on the lowest total casualty rate per million man-hours, in each of seven groups. The seven roads receiving the awards were the Union Pacific System, the Union Pacific Railroad, the Oregon Short Line, the Los Angeles & Salt Lake, the Duluth, Missabe & Northern, the Duluth & Iron Range and the Baltimore, Chesapeake & Atlantic.

**Senator Brookhart,** of Iowa, has introduced a bill in the Senate which would authorize the Interstate Commerce Commission to acquire by purchase or condemnation such existing transportation facilities as would be needed to provide a transcontinental line and to issue government bonds for the purpose. The bill further provides for the formation of a Federal Railroad Corporation to manage the road, with a capitalization of $1,000,000, the stock to be sold to persons skilled in railroad operation. All earning in excess of 10 per cent would be used to retire the bonds. In addition the bill would authorize the commission to acquire other railway lines "when it shall deem the same to be in the public interest."

**The National Lumber Manufacturers' Association** has established an information and technical service for the users of lumber and timber in construction or for other purposes and has retained a staff of 30 engineers and specialists for research activities, the results being supplied generally in the torm of bulletins. These men are located in groups in every section of the country and are prepared to handle all problems relating to the use of wood in architecture and engineering as well as in other branches of the industrial field.

**Revenue freight car** loadings for the week ending May 12 amounted to 1,001,983 cars, the first time that the million-car mark has been reached in weekly loadings during the present year. This total represents an increase of 22,321 cars over the preceding week, but it a decrease of 27,441 as compared with the corresponding week in 1927 and of 27,765 as compared with 1926. The cumulative total for the first 19 weeks of the current year is 17,509,388 as compared with 18,470,899 and 18,058,395 in the corresponding periods in 1927 and 1926, respectively.

**The pioneer bore** of the new Cascade tunnel of the Great Northern was holed through on the afternoon of May 1, the final shot being set off by President Coolidge at the White House in Washington by the pressure of a telegraph key. A preliminary check of the work, made after the final blast, showed that the difference between the actual and calculated distance was less than one foot, that the difference in alinement was six inches and the difference in elevation was three inches. A banquet was held at the construction headquarters at the west end of the tunnel on the evening of May 1, at which was read a congratulatory message from Ralph Budd, president of the Great Northern.

**The flood control bill,** considerably modified from the form in which it was first passed by the House and the Senate, was signed by President Coolidge on May 15. As amended it provides that "no liability of any kind shall attach to or rest upon the United States for any damages from or by floods or flood waters at any place," with the proviso that if it is found that it is impracticable to construct levees on the banks of any stretch of the Mississippi river, and lands not now overflowed are subject to overflow or damage it shall be the duty of certain United States officers to institute proceedings to acquire either absolute ownership of such lands or floodage rights over them. An original provision that "just compensation shall be paid by the United States for property used, taken, damaged or destroyed in carrying out the flood control plan provided for herein—and also including all expenditures by persons, corporations, and public service corporations made necessary to adjust or conform or to relocate same because of the spillways, floodways and diversion channels," was stricken from the bill. A provision of this nature had been urged by a committee of engineers of the railways traversing the flooded districts, who estimated that the changes in their property made necessary by the plan will involve an expenditure of $71,000,000.

**Railroad courses** for business executives are to be given at the special summer session of the Graduate School of Business Administration at Harvard University, beginning on July 9 and continuing until August 18. The work has been divided into two sections, one of which, the administrative section, will be in charge of Professor William J. Cunningham of Harvard, while the section on rates and regulation will be conducted by Professor Winthrop M. Daniels of Yale. The administrative section will treat of the various problems relating to organization, operation and maintenance, accounting and statistics, and motor transportation, and the other section will concern itself with the development of rates, federal legislation, valuation and recapture, consolidations, the financial structure and the operation and functioning of the Interstate Commerce Commission. Written cases of actual railroad problems will form the basis of both the written and classroom work and it is desired to obtain men who will be competent to engage in general discussion of the topics presented. Admission to the courses will ordinarily be limited to executives and teachers. The total tuition is $200, including a $25 matriculation fee to accompany the application, which should be sent to Miss M. B. Fox, secretary, Soldier's Field, Boston, Mass.

## Construction News

**The Atchison, Topeka & Santa Fe** has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 300-ton capacity three-track, reinforced concrete locomotive coaling station at Great Bend, Kan. This construction also includes the installation of a 50-ton gravity sand drying plant at the same point. A contract has been let to Fairbanks, Morse Co., Chicago, for the construction of a 500-ton four-track reinforced concrete coaling station at Galesburg, Ill. This plant will be of the automatic type, operated by electric motor, and will be equipped with scales for weighing coal as it is delivered to locomotives.

It is expected that a contract for the construction of a viaduct over the tracks of this company and the Missouri Pacific at Sixth avenue, Topeka, Kan., will be let before July 1. The viaduct, which will be of steel and concrete construction, will be 1,479 ft. long with a 36 ft. roadway and two 5 ft. sidewalks. The total cost of the viaduct, which is estimated to be about $500,000, will be borne by the Santa Fe, the Missouri Pacific and the City of Topeka.

**The Baltimore & Ohio** has awarded a contract for the construction of a 300-ton, three-track reinforced concrete automatic electric coaling station, a 150-ton reinforced concrete gravity sand drying plant and a four-track multiple pit cinder handling plant at the Rossford terminal at Toledo, O., to Roberts & Schaefer Co., Chicago. A contract for the construction of a water treating plant with pumping facilities at Cumberland, Md., has been awarded to Bickelhaupt, Inc., Richmond, Va. The project is estimated at a cost of approximately $85,000. Bids were received until May 22 for the construction of water treating plants at Griffiths, Pa., Layton and Wildwood.

**The Bessemer & Lake Erie** has closed bids for work to cost approximately $1,121,600 in connection with the completion of grade reductions and line changes on the southbound track between Filer and Coolspring, Pa. A change of line and grade reduction at Harrisville, Pa., to cost approximately $150,000, has been authorized.

**The Canadian National** received bids until May 15 for the construction of a one-story brick addition to the freight shed at Saskatoon, Sask. The addition will be 400 ft. long and included in this project will be the construction of a two-story brick office building.

Legislation authorizing this road to increase from $7,000,000 to $10,500,000 the bond issue to take care of additions to proposed improvements in the Toronto terminals has been discussed in the House of Commons of Canada. The additional facilities proposed include an engine house, office building and express terminal. This company also contemplates the construction of a hotel at Halifax at an estimated cost of $1,125,000.

**The Canadian Pacific** has awarded contracts for the construction of a concrete, brick and steel addition to the locomotive shops at Weston, near Winnipeg, Man., to Claydon & Co., and R. N. Wyatt, both of Winnipeg.

A contract has been awarded to the Stewart Construction Company, Winnipeg, Man., for the construction of an extension from Swift Current, Sask., to Stewart Valley, about 25 miles. A contract has also been let to the Nickerson Construction Company, Vancouver, B. C., for lining with concrete two tunnels on the main line on the Shuswap division and one tunnel on the main line on the Mountain division in British Columbia.

**The Chicago, Burlington & Quincy** has awarded a contract to the T. S. Leake Construction Company, Chicago, for the construction of three cinder pits, two inspection pits and seven wash tables at Western avenue and Sixteenth street, Chicago.

This company plans the immediate construction of a boathouse at the foot of South Sangamon street and the Chicago river at Chicago for the transfer of freight from lake steamers to freight cars. Outside dimensions of the house will be 450 ft. by 60 ft., with three tracks affording a capacity for 36 cars. The new pier will take the place of the present structure at Sixteenth street which must be abandoned due to the channel change of the Chicago river between Polk and Eighteenth streets.

**The Chicago, Milwaukee, St. Paul & Pacific** plans the elevation of its line between Church and Central streets, Evanston, Ill., which is used by the Chicago, North Shore & Milwaukee. The cost of the work is estimated at $2,500,000. A contract for the construction of a ground-operated water treating plant at South Minneapolis, Minn., has been let to the Phelps-Drake Company, Minneapolis, Minn. This plant will have a capacity of 700 gal. per min. or about 1,000,000 gal. per day. A contract has been awarded to the Pittsburgh-DesMoines Steel Company, Des Moines, Iowa, for the construction of a water treating plant at Spencer, Iowa, which will have a capacity of 6,000 gal. per hour.

**The Chicago, Rock Island & Pacific** has authorized the construction of a water treating plant at El Reno, Okla., with a capacity of 42,000 gal. per hour and a coaling station at Estherville, Iowa, with a capacity of 200 tons.

Plans have also been prepared for the reduction of grades on 10.8 miles of the line between Bureau, Ill., and Sheffield from a maximum of 0.6 per cent to a maximum of 0.3 per cent.

**The Cleveland Union Terminals** closed bids on May 15 for the construction of a three-level station building and viaducts at Cleveland, which are estimated to cost approximately $8,000,000.

**The Great Northern** has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 500-ton electrically operated steel coaling station at Willmar, Minn.

**The Gulf, Colorado & Santa Fe** has awarded a contract for the construction of a one-story reinforced concrete and steel machine shop at Cleburne, Tex., to H. D. McCoy, Cleburne. The building will have outside dimensions of 202 ft. by 515 ft.

**The Illinois Traction System** has asked the Board of Aldermen of the City of St. Louis, Mo., for a 50-year franchise which will allow the construction of underground terminal facilities at Lucas avenue and High street, the construction of a double-track underground line between Cass street and the terminal and the construction of an elevated line from the McKinley bridge to Branch street. The entire project is expected to cost about $5,000,000.

**The Kansas City Southern** has prepared plans for the construction of a line between Leeds, Mo., and Grandview, 13 miles, to afford an entrance to Kansas City, Mo., over its own rails. It is planned to construct the line with a 0.5 per cent compensated maximum grade corresponding with the balance of the first operating district out of Kansas City and permitting operating economies not now possible on the heavy grade of the present entrance into Kansas City. The cost of the project is estimated at $3,000,000. It is planned to receive bids for all of the work except that of track laying and ballasting about June 15.

**The Los Angeles & Salt Lake** budget for 1928 calls for the construction of new bridges over the San Gabriel river and the Rio Hondo in California at a total cost of about $400,000. It is also planned to improve an industrial area owned by this company in the vicinity of Los Angeles, Cal., by the construction of concrete roads, sanitary and storm sewers and public utility facilities.

**The Minneapolis, St. Paul & Sault Ste. Marie** has awarded a contract for the construction of a 200-ton coaling station at Lake Villa, Ill., to Fairbanks, Morse & Co., Chicago. A contract has also been awarded to the same company for the construction of a 200-ton coaling station and a two-track cinder, conveyor at Schiller Park, Ill., in the outskirts of Chicago. The yard at Schiller Park will be increased in capacity from 25 to 30 per cent and a new main track will be built around the outside of the yard.

**The Missouri - Kansas - Texas** construction program for 1928 will involve the expenditure of $3,821,000 for improvements to the right-of-way and

structures. The replacement of light bridge spans with heavier structures will require an expenditure of $182,000 while the replacement of trestle bridges with permanent structures and embankments will require the expenditure of $505,000. At Eureka (Houston), Tex., it is planned to spend $151,000 for the construction of new yard tracks, and a water treating plant will be constructed at Smithville, Tex., to cost $25,000. About $98,000 will be expended in the vicinity of Rocheport, Mo., as part of the program for the reduction of all curves on the main line to a maximum of 3 deg. while at Wilsonton, Kan., $159,000 will be spent for the reduction of grade from a maximum of 0.7 per cent to 0.5 per cent.

**The Missouri Pacific** has let a contract for the superstructure of the Baring Cross bridge over the Arkansas river at Little Rock, Ark., to the American Bridge Company, Chicago, at a cost of $407,000, including both fabrication and erection. Plans call for the construction of a bridge which will have a total length of 1,024 ft., including one lift span.

**The New York, New Haven & Hartford** has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of an electric cinder plant at Danbury, Conn., and five fireproof sand storage towers for electric locomotives, three to be constructed at Cedar Hill yard, New Haven, Conn., and two at Oak Point, N. Y.

An expenditure of $320,000 has been authorized for the erection of a two-story brick building at its Fargo Street yard, Boston, Mass. The first floor, to be used for handling produce, will be served by two tracks with platforms and concrete driveways on each side.

**The Oregon-Washington Railroad & Navigation Company** has prepared plans for the construction of additional storage tracks at Albina, near Portland, Ore., which, with the cost of land, will involve an expenditure of $106,000. Between Meacham, Ore., and Huron it is planned to spend $157,000 for the widening of cuts and the restoration of embankments. Work on this seven-mile stretch of line will mark the completion of a five-year program of improvements on the line between Pendleton, Ore., and Huntington, 174 miles.

**The Pennsylvania** has awarded a contract to the Blaw-Knox Company, Pittsburgh, Pa., for the erection of an engine house at Little Creek, Norfolk, Va. H. F. Curtis, Philadelphia, Pa., has been awarded a contract for grading, masonry, paving, curbing and track laying in connection with the new freight station at Trenton, N. J. This project is estimated at a cost of $500,000. A contract for furnishing and erecting a lift bridge and two approach spans for the Newark Bay bridge at Greenville, N. J., has been let to the Bethlehem Steel Co., Bethlehem, Pa. This work is to cost about $760.000.

An expenditure of $5,000,000 has been authorized for the construction of a freight and produce terminal at Pittsburgh, along the Allegheny river from 11th street to 24th street. In connection with this work, the John F. Casey Company, Pittsburgh, Pa., has been awarded the contract for grading, sewer and track work between 13th and 16th streets and storage track between 43rd and 48th streets at a cost of $100,000.

This road has made public the details of the proposed contracts whereby a new railroad station and tube terminal will be erected at Newark, N. J. at a cost of $25,000,000. Under the terms of a contract the railroad agrees to build a new station at Market street; to construct two new bridges over the Passaic river to facilitate train traffic; to abandon Manhattan Transfer and to make the new station the transfer point for downtown New York. It is estimated that the railroad will spend $12,500,000, while the city will spend $7,000,000 on the station and $5,500,000 in connection with other details.

The city of Ft. Wayne, Ind., has reached an agreement with this company for the construction of a street subway under its tracks at Anthony boulevard. The cost of the structure, which is estimated at $195,000, will be borne by the city and the railroad with the railroad contributing 65 per cent of the amount.

**The Reading** is receiving bids for the erection of its new passenger-express terminal at North Broad street, Philadelphia, Pa., which will involve the expenditure of approximately $2,000,000.

**The Rutland** has authorized an expenditure of $227,500 for a two-span, through truss bridge which will include the underpinning of the old pier and the facing of the old abutments on its line over the Winooski river. Bids for the construction of the substructure closed May 4. No request has yet been made for bids on the steelwork.

**The St. Louis-San Francisco** and the City of St. Louis, Mo., have agreed to share equally the cost of constructing a street subway under the railroad's tracks at Wellington avenue, St. Louis. The total cost of the structure will be about $149,000.

**The St. Louis Southwestern** has awarded a contract to the Gifford-Hill Construction Company, Dallas, Tex., for the grading and concrete work on 67 miles of grade revision and line relocation between Mount Pleasant, Tex., and Tyler. The project involves the excavation of about 1,800,000 cu. yds. of earth and the construction of about 14 miles of new track. The laying of rail and ballasting will be undertaken by company forces. The total cost of the work is estimated at $1,900,000.

**The Terminal Railroad Association** of St. Louis has announced plans for the enlargement of the Union station at St. Louis, Mo., at a cost of several million dollars which when completed will increase the capacity of the passenger, express, mail and baggage facilities about 60 per cent. The change will enable the terminal to handle 465 instead of the present 290 trains per day and will increase the car capacity from the present 1,800 cars to 2,800 cars per day.

**The Texarkana Union Station** has awarded a contract for the construction of a union passenger station at Texarkana, Tex., and Ark., to be used by the Kansas City Southern, the Missouri Pacific, the St. Louis Southwestern and the Texas & Pacific, to the Stewart-McGehee Construction Company, Little Rock, Ark. The total cost of the station proper is estimated at $1,000,000 and an additional $500,000 will be expended for improvements incidental to the station construction. The contract requires the completion of the station by November 9, 1929, and the completion of the main building by October 7, 1928.

**The Toronto, Hamilton & Buffalo** has prepared preliminary plans for the construction of a modern engine terminal on a 21-acre tract which it has recently acquired at Hamilton, Ont. The new facilities which are estimated to cost approximately $1,000,000, will comprise a 25-stall brick engine house, repair shop and coaling plant, storehouse and oil house, locker building, cinder pits, standpipes, and a 200,000-gal. water tank. Construction of the coaling plant, cinder pits and water service facilities, together with grading, foundation, sewer and roadway work is expected to commence this year. It is planned to complete the project next year.

**The Union Pacific** improvements planned for the terminal facilities at Gering, Neb., will include, in addition to the new passenger station, the construction of new team tracks, a five-stall enginehouse, a machine shop, a power house, and a coaling station and cinder-handling plant. The total cost of the projected construction at Gering will be about $331,000. The plans for the construction of a one-story passenger station at Marysville, Kan., provide for the expenditure of about $135,000 for a building which will have outside dimensions of 166 ft. by 38 ft. This station will be constructed of brick and terra cotta.

Present plans of this railroad for 1928 call for the construction of new water treating plants at North Platte, Neb., Bitter Creek, Wyo., and Manhattan, Kan., and the enlarging and remodeling of existing water treating plants at Schuyler, Neb., Kearney and Kimball and Dorrance, Kan., at a total expenditure of about $90,000. A contract has been awarded to the T. W. Snow Construction Company, Chicago, for the furnishing of material and equipment required for the construction of coaling stations of 50 tons capacity each at Gering, Neb., and Yoder, Wyo., and Albin.

# Supply Trade News

## General

**The Magor Car Corporation** has moved its office from 30 Church street to 50 Church street, New York.

**The Omaha Boarding & Supply Company** has moved its Chicago office from 6 Canal street to 12-14 South Jefferson street.

**The Marion Steam Shovel Company** has moved its Chicago office to the McCormick building, 322 South Michigan avenue, Chicago.

**The Railroad Supply Company,** Chicago, has opened an office at 908 State Planters Bank Building, Richmond, Va., in charge of **J. C. Duranceau.**

**The Kansas City Structural Steel Company** has moved its district sales office in Denver, Colo., from 412 First National Bank building to 410 Tramway building.

**The Linde Air Products Company** has opened a new district sales office at 48 West McLemore Avenue, Memphis, Tenn., with **H. N. Smith,** district manger in charge.

**The Clark Car Company,** Pittsburgh, Pa., has moved its general office to 1310 Clark building in that city. The New York office has been moved from 52 Vanderbilt avenue to 30 Church street.

**Ingersoll-Rand, Inc.,** has succeeded the Ingersoll-Rand Drill Company, with offices at 314 North Broadway, St. Louis, Mo. A branch operating under the St. Louis office has been opened at 226 West A street, Picher, Okla.

**The Truscon Steel Company,** Youngstown, Ohio, has purchased the Hydraulic Pressed Steel Company, Cleveland, Ohio, and will operate it as its pressed steel division. The entire plant is being completely modernized.

**The W. N. Matthews Corporation,** St. Louis, Mo., has moved its Chicago office to 9 South Clinton street. **E. B. Josler,** formerly with the Central States General Electrical Supply Company, has been appointed representative, with headquarters at Chicago.

**The Roller Bearing Co. of America,** Newark, N. J. has purchased the plant of the Mercer Motor Car Co., at Trenton, N. J. At this new plant the company will install its present equipment and will add such new equipment as is necesary to take care of its increasing business. The plant acquired occupies 11½ acres and the buildings have 175,000 sq. ft. of floor space.

**The McMyler-Interstate Company** was placed in the hands of the receiver on April 23 as the result of a petition of the largest holder of common stock, who brought a friendly action to protect the company. The petition stated that while the assets far exceed the liabilities, the company owes $2,000,000 and has been unable to secure additional financing to pay some of the creditors who have refused to grant extensions.

**Lyon Metal Products, Inc.,** Aurora, Ill., has been organized and has purchased the Durand Steel Locker Company, Chicago Heights, Ill., and the Lyon Metallic Manufacturing Company, Aurora. The following have been elected as officers of the new company: Chairman of the board, **H. A. Gardner,** formerly secretary of the Durand Steel Locker Company; president, **F. S. Waters,** formerly president of the Lyon Metallic Manufacturing Company; vice-presidents, **Keith Spaulding,** formerly president of the Durand Company; **Walter N. Vance,** formerly engineer and plant manager of the Durand Company, and **C. E. Gerberich,** formerly with the Lyon Metallic Company; secretary, **B. L. Walters,** formerly of the Lyon Metallic Company; assistant secretary, **Henry A. Struck,** formerly manager of sales of the Durand Company; treasurer, **W. B. Brown,** formerly with the Durand Company, and assistant treasurer, **A. W. Lauder,** formerly director of advertising of the Lyon Metallic Company.

**Fairmont Railway Motors, Inc.,** Fairmont, Minn., and **Mudge & Co.,** Chicago, have been merged and will operate under the name of Fairmont Railway Motors, Inc., after June 1, with general offices at Fairmont and general sales offices in the Railway Exchange building, Chicago. All types and classes of cars heretofore manufactured by each company will be manufactured by the new company and branch offices will be maintained in New York, Washington, D. C., St. Louis, Mo., New Orleans, La., San Francisco, Cal., Winnipeg, Man., and Mexico City, Mex.

The officers of the company are as follows: Chairman of the board, **H. E. Wade,** formerly president of the Fairmont company; vice-chairman of the board, **J. P. Dunning,** formerly vice-president of the Fairmont company; president, **Robert D. Sinclair,** formerly president of the Mudge company; vice-presidents, **W. F. Kasper,** formerly chief engineer and manager of sales of the Fairmont company, and **Albert C. Force,** formerly vice-president and treasurer of the Mudge company; treasurer, **H. M. Starrett,** formerly treasurer of the Fairmont company; and secretary, **A. R. Fancher,** formerly secretary of the Fairmont company.

## Personal

**H. Van Zandt,** sales representative of the Illinois Steel Company, has been promoted to assistant general manager of sales in charge of the structural steel division.

**B. Kuckuck,** who was active in the introduction of the Reuping process of wood preservation into this country a number of years ago and who more recently has been chief engineer of a large wood preserving company in Europe, has been appointed chief engineer of the Curtin-Howe Corporation, New York, which is introducing the zinc meta-arsenite method of timber treating.

**Ross F. Hayes,** 50 Church street, New York City, has been appointed general sales agent at New York for the Hastings Signal & Equipment Company of Boston.

**J. E. Heber** has been appointed vice-president of the Truscon Steel Company, Youngstown, Ohio, with headquarters at Los Angeles, Cal., where he will be in charge of activities on the Pacific Coast.

**F. A. Ernst,** formerly representative of the American Rolling Mill Company, with headquarters at Chicago, has been appointed assistant district sales manager of the Inland Steel Company, with headquarters at St. Louis, Mo.

**J. L. Terry,** who has been identified with the Q. & C. Company for many years and who has been in charge of the Southwestern territory, with headquarters at St. Louis, Mo., has been elected vice-president in charge of sales, with headquarters at Chicago.

## Trade Publications

**Concrete Floors.**—In an attractive, well-illustrated 30-page bulletin entitled "Plain Talk About Concrete Floors," the Master Builders Company, Cleveland, Ohio, has included a large amount of interesting and highly informative practical information relative to plain concrete and surface-hardened concrete floors.

**Clamshell Buckets.**—The Owen Bucket Company, Cleveland, Ohio, has published a new catalog of 16 pages, which embraces the complete new line of buckets manufactured by this company, giving information regarding the weights, capacities, dimensions, etc., of each type of bucket. In addition, it recommends the best type of Owen bucket for various classes of service.

**Armco Ingot Iron.**—The second edition of "Armco Ingot Iron—Its History and Service," has been published by the American Rolling Mill Company, Middletown, Ohio, under the new title "Armco Ingot Iron—Its Development and Service." This second edition is a complete revision of the first edition, and as the new title implies, deals with the development, characteristics, and making of Armco ingot iron.

**Steel Joists and Stanchions.**—A new handbook has been published by the Bethlehem Steel Company, Bethlehem, Pa., on Bethlehem steel joists and stanchions for use in the lighter types of steel frame buildings. This handbook, which contains much valuable information for those interested in the economical design of relatively light steel buildings with relatively light floor loads, is put out in pocket size for the convenience of those using it.

# Personal Mention

## General

**R. P. Graham,** division engineer of the Middle division of the Eastern region of the Pennsylvania, with headquarters at Altoona, Pa., has been promoted to superintendent of the Delaware division, with headquarters at Wilmington, Del.

**L. L. Morton,** special engineer on the Louisville & Nashville, with headquarters at Louisville, Ky., has been appointed superintendent of the New Orleans and Mobile division with headquarters at New Orleans, La. Mr. Morton was born on April 2, 1884, at Mt. Eden, Ky., and was educated at Centre College. He entered railway service in 1906 in the engineering department of the Atlanta, Birmingham & Atlantic (now the Atlanta, Birmingham & Coast) where he was engaged in construction work until 1909 when he entered the engineering department of the Kansas City Southern. He became an assistant engineer on the Louisville & Nashville in 1912 and later was promoted to special engineer, with headquarters at Louisville, which position he was holding at the time of his recent promotion to superintendent of the New Orleans and Mobile division. Mr. Morton was in the United States Army from 1917 to 1919, where he served successively as captain, major and lieutenant-colonel of engineers.

**Walter T. Moodie,** superintendent of the Rainy River division of the Canadian National, with headquarters at Port Arthur, Ont., and an engineer by education and experience, has been promoted to general superintendent of the Northern Ontario district, with

**Walter T. Moodie**

headquarters at North Bay, Ont. Mr. Moodie was born on March 10, 1882, at Glasgow, Scotland, and was educated at the Royal Technical College in that city. He entered railway service in April, 1903, as an assistant engineer on the Caledonian (now part of the London, Midland & Scottish) and in the early part of 1905 went to South Africa to become an engineer on the location and construction of the Central South African Railway at Johannesburg, Transvaal. He was engaged later in engineering work in connection with location, construction and improvement on railways in the Orange Free State and the Transvaal. He came to Canada in May, 1908, and became an engineer in the construction department of the Canadian Northern (now a part of the Canadian National). He was promoted to division engineer, with headquarters at Winnipeg, Man., in 1911, and was further promoted to district engineer, with headquarters at the same point in December, 1916. Mr. Moodie entered the operating department in January, 1916, as superintendent of the Rainy River division, with headquarters at Port Arthur, Ont., which position he was holding at the time of his promotion to general superintendent of the Northern Ontario division on May 1.

**D. W. Orr,** superintendent of the Arkansas River division of the Atchison, Topeka & Santa Fe, with headquarters at La Junta, Colo., whose early railway training was in the maintenance of way department has retired from active duties after a continuous service of 46 years with that road. Mr. Orr was born in 1859 and entered railway service on February 1, 1882, as a section laborer on the Arkansas River division at Cimarron, Kan., later being promoted to section foreman. On July 13, 1889, he was promoted to roadmaster, with headquarters at Cleburne, Tex., returning to the Arkansas River division as section and extra gang foreman on April 14, 1892. On August 1, 1895, he was promoted to roadmaster on the Colorado division, with headquarters at Pueblo, Colo., and this was followed on November 1 of the same year by his further promotion to track inspector on the Northern district of the Western lines. He entered the operating department as a trainmaster on the Rio Grande division on November 1, 1907, and was promoted to assistant superintendent of the Arkansas River division on April 1, 1909. Two months later he was promoted to superintendent of the same division, with headquarters at La Junta, which position he was holding at the time of his recent retirement.

## Engineering

**C. A. Hopkins,** has been appointed valuation engineer of the Chicago & Illinois Midland, with headquarters at Springfield, Ill.

**I. Romo,** chief engineer of the Interoceanic of Mexico with headquarters at Puebla, Pueb., has resigned incident to the merging of that road with the National Railways of Mexico.

**F. G. Morss,** engineer and purchasing agent of the Uintah Railway, with headquarters at Mack, Colo., has been transferred to the engineering department of the Trinidad Lake Asphalt Operating Company, with headquarters at Trinidad, British West Indies, both these companies being controlled by the General Asphalt Company.

**J. E. Armstrong,** assistant engineer on the Canadian Pacific with headquarters at Montreal, Que., has been promoted to assistant chief engineer, with headquarters at the same point, and **A. R. Ketterson** has been appointed assistant engineer of bridges with headquarters at Montreal.

Mr. Armstrong was born on September 29, 1886, at Peoria, Ill., and was educated at Cornell University. He entered railway service with the Toledo, Peoria & Western, where he was employed in various capacities in the mechanical and engineering departments until 1906. In August, 1908, he entered the service of the Pennsylvania as an assistant on an engineer corps at Cleveland, Ohio, and in August, 1912, became assistant engineer in the office of the chief engineer of the Canadian Pacific at Montreal, which position he was holding at the time of his promotion to assistant chief engineer on May 1.

**Edward Wise, Jr.,** assistant engineer in the office of the chief engineer of the Louisville & Nashville at Louisville, Ky., has been promoted to special engineer, with headquarters at the same point, to succeed **L. L. Morton,** whose promotion to superintendent of the New Orleans and Mobile division is noted elsewhere in this issue. Mr. Wise, who is 34 years old and who was educated at the Kentucky State University, entered railway service on June 9, 1913, as a rodman on the L. & N., at Lexington, Ky., and was promoted to assistant resident engineer in January of the following year, continuing in this capacity until January, 1916, when he became a topographer on preliminary and location surveys and later served as assistant resident engineer on the construction of the Decoursey yard. During 1917, Mr. Wise left railway service for a few months, returning to the L. & N. on August 27 of that year as a draftsman. He was promoted to assistant engineer on the Knoxville division on January 24, 1919, and later in the same year was transferred to the chief engineer's office, where he was engaged at the time of his promotion to special engineer on May 1.

**D. M. Rankin,** office engineer in the office of the division engineer of the Southern Kansas division of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been promoted to division engineer of that division, succeeding **H. A. Hatch** who has been assigned to other duties in the office of the chief engineer of the Eastern lines at Topeka, Kan.

Mr. Rankin was born on March 29, 1891, at Lecompton, Kan., and was educated at the University of Kansas, where he graduated in 1915. He entered railway service on August 15 of the same year as a chainman on the Eastern division of the Santa Fe and was promoted successively to rodman

and transitman. He entered the United States Army on April 15, 1918, where he served in the meteorological section of the signal corps, and on his return to civil life, resumed his position of transitman on the Santa Fe on May 1, 1919. He was promoted to assistant engineer in the office of the chief engineer at Topeka, Kan., on May 16, 1924, and on December 16, 1926, was further promoted to office engineer in the office of the division engineer of the Southern Kansas division at Chanute, Kan., which position he was holding at the time of his recent promotion to division engineer of that division.

### Changes on the Pennsylvania

Two general divisions have been organized in the Western region of the Pennsylvania, each under the charge of a general superintendent. The Northwestern general division, with headquarters at Chicago, embraces the Chicago Terminal division and the Ft. Wayne, Logansport, Toledo, and Grand Rapids divisions, while the Southwestern general division, with headquarters at Indianapolis, Ind., includes the Columbus, Cincinnati, St. Louis, and Indianapolis divisions.

**W. S. Johns, Jr.,** engineer maintenance of way on the Western region, with headquarters at Chicago, has been appointed engineer maintenance of way of the Northwestern general division with headquarters at the same point, and **Ralph H. Pinkham,** superintendent of the Ft. Wayne division, has been appointed engineer of the Southwestern general division with headquarters at Indianapolis.

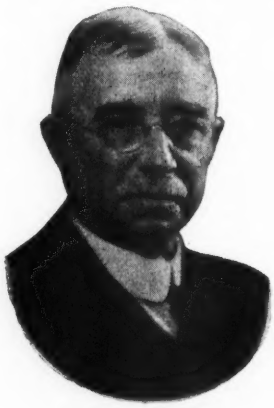
Mr. Pinkham was born on January 16, 1880, at Nashua, N. H., and graduated from the Massachusetts Institute of Technology in 1899. He entered

Ralph H. Pinkham

railway service in June, 1899, as a draftsman in the engineering department of the Pennsylvania and in April, 1902, was promoted to asisstant supervisor. In July, 1908, he was promoted to supervisor, with headquarters at Millville, N. J., and in October, 1915, was further promoted to division engineer, with headquarters at Erie, Pa. Mr. Pinkham entered the operating department in February, 1918, as assistant superintendent at Cresson, Pa., and in September of the same year was promoted to superintendent of the Norfolk division, with headquarters at Cape Charles, Va. He was transferred to the Ft. Wayne division, with headquarters at Ft. Wayne, Ind., in 1922, where he was located at the time of his recent promotion to engineer maintenance of way of the Southwestern general division of the Western region.

A sketch and photograph of Mr. Johns was published on page 190 of the April issue of *Railway Engineering and Maintenance.*

**H. R. Leonard,** chief engineer of bridges and buildings of the Pennsylvania system, with headquarters at Philadelphia, Pa., has retired from active service under the pension regulations. Mr. Leonard was born on April 13, 1858, at Boston, Mass., and on March 1, 1874, entered the chief engineer's department of Boston, where he was engaged in general construction and the design of bridges. In March, 1883, he became an engineer with Cofrods & Saylor at the Philadelphia Bridge works, remaining in this position until 1896, during which time he was engaged in designing and con-



H. R. Leonard

structing a number of bridges and other structures on the Pennsylvania. In 1897 he was connected with the Leonard, Foley Construction Company. During 1899 and 1900, Mr. Leonard made a general survey and inspection of all the metal bridges on the Southern, after which he entered the service of the American Bridge Company as a contracting engineer. On March 1, 1902, he was appointed engineer of bridges of the Pennsylvania, with headquarters at Philadelphia, remaining in this position until March 1, 1906, when he was made engineer of bridges and buildings, with the same headquarters. On April 1, 1923, he was promoted chief engineer of bridges and buildings of the entire system, which position he was holding at the time of his retirement on May 1.

**J. C. White,** formerly division engineer of the recently abolished Richmond division, with headquarters at Richmond, Ind., has been transferred to the Logansport division, with headquarters at Logansport, Ind., succeeding **D. B. Johnston,** who has been appointed assistant engineer maintenance of way in the office of the chief engineer maintenance of way at Chicago. **F. A. Cellar,** assistant to the division engineer of the Richmond division, has been transferred to the Cincinnati division, with headquarters at Cincinnati, Ohio, to succeed **M. Coburn,** transferred.

**Robert Faries,** whose promotion to assistant chief engineer of maintenance of the Pennsylvania system, with headquarters at Philadelphia, Pa., was noted in the March issue, was born on No-

Robert Faries

vember 30, 1881, at Bellwood, Pa., and entered railway service on May 5, 1899, as a rodman on the Pennsylvania. He was promoted to supervisor, with headquarters at Jamesburg, N. J., on August 1, 1905, and later was transferred successively to Trenton, N. J., and to Washington, D. C. On June 1, 1917, he was promoted to division engineer at Elmira, N. Y., later serving in the same position at Williamsport, Pa., and Pittsburgh. On November 1, 1924, he entered the operating department as superintendent of the Buffalo division, with headquarters at Buffalo, N. Y., which position he was holding at the time of his promotion to assistant chief engineer of maintenance of the Pennsylvania system.

## Track

**R. Rossi,** supervisor on construction on the Chicago & Western Indiana, with headquarters at Chicago has resigned on account of the approaching completion of the work on which he was engaged.

**E. K. McNeil,** of the engineering department of the Atchison, Topeka & Santa Fe, has been promoted to roadmaster on the Western division, with headquarters at Santata, Kan. Mr. McNeil was born on November 8, 1889, at Louisville, Colo., and was educated at the University of Colorado, where he graduated in 1915. He entered railway service on August 16 as a rodman on maintenance on the Santa Fe at La

Junta, Colo., and was promoted to transitman in March, 1917. Mr. McNeil was in military service during 1918 and 1919, and after leaving the army resumed his position as transitman on the Santa Fe, in which capacity he was serving at the time of his recent promotion to roadmaster.

**A. E. McCullough** has been appointed supervisor on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Connersville, Ind., to take the place of **S. Johnson**, who has been transferred to Greensburg, Ind., to succeed **A. C. Rupp**, notice of whose death will be found elsewhere in this issue.

**A. Terry**, roadmaster on the St. Louis-San Francisco, with headquarters at Chaffee, Mo., has resigned and his former territory has been added to that of **J. W. Ellis**, with headquarters at the same point. The headquarters of **W. E. Counts**, roadmaster, formerly at Cuba, Mo., and those of **J. Daugherty**, roadmaster formerly at Lebanon, Mo., have been moved to Newburg, Mo.

**Carl L. Cansler**, a track foreman on the Southern, has been promoted to supervisor on the Memphis division, with headquarters at Huntsville, Ala., succeeding **A. Williams**, who has resumed his former position of section foreman at Huntsville. **J. S. Wearn** has been appointed supervisor, with headquarters at Knoxville, Tenn., succeeding **W. H. Wood**, who has been transferred to Johnson City, Tenn., to take the place of **J. W. Price**, deceased.

**T. D. Ruggles**, roadmaster on the Manitoba district of the Canadian Pacific, has been transferred to the Ontario district, with headquarters at Kenora, Ont., to succeed **G. Kostiuk**, who has been transferred to the Alberta district, with headquarters at McLeod, Alta., where he succeeds **H. W. Clarkson**, who has been transferred to Coronation, Alta., to take the place of **M. P. Fitzpatrick**, who has been transferred to Lacombe, Alta.

**A. Shirley**, track foreman on the Toronto Terminal division of the Canadian National has been promoted to acting roadmaster of the same division to succeed **H. E. Clare**, who has been transferred to the St. Thomas division, with headquarters at St. Thomas, Ont., where he takes the place of **W. Wharry**, retired. **P. Woods** has been appointed roadmaster on the Regina division of the Western region, with headquarters at Radville, Sask., succeeding **H. L. Roblin**, who has been transferred to Regina, Sask., to succeed **J. Smith**, transferred.

**G. J. Willingham**, an engineer on the construction of the new line of the Illinois Central between Edgewood, Ill., and Fulton, Ky., which has recently opened for traffic, has been appointed supervisor on that portion of the line between Bluford, Ill., and Reevesville, with headquarters at Bluford. **J. W. Swartz**, assistant engineer on the Springfield division has been promoted to supervisor on the St. Louis division, with headquarters at Carbondale, Ill., succeeding **C. I. VanArsdalen** who has been transferred to the Springfield division to succeed **Peter Cheek.**

**J. J. Tobean**, a general foreman on the Eastern region of the Pennsylvania, has been promoted to assistant supervisor on the Buffalo division, with headquarters at Struthers, Pa. **E. R. Burchette**, track foreman on the Norfolk division of the Eastern region, has been promoted to assistant supervisor on the St. Louis division with headquarters at Greenville, Ill., succeeding **L. F. Beard**, who has been transferred to Terre Haute, Ind. **J. P. Newell**, has been appointed assistant supervisor on the Conemaugh division with headquarters at Sharpsburg, Pa., to succeed **L. O. Shanely**, who has been furloughed. **W. P. Geiser** has been appointed assistant supervisor on the Allegheny division, with headquarters at Kittanning, Pa., to succeed **H. E. Conklin** who has been transferred to the Pittsburgh division with headquarters at Derry, Pa., where he replaces **J. L. Huron**, who, in turn, has been transferred to the Akron division with headquarters at Akron, Ohio, to succeed **R. J. Moore**, who has been furloughed. **L. C. Martoia**, assistant supervisor on the Conemaugh division, has been transferred to the Panhandle division with headquarters at Dennison, Ohio, succeeding **F. A. Dever** who has been transferred to the Pittsburgh division, with headquarters at Trafford, Pa., to take the place of **Joseph Summers**, whose appointment as supervisor on the Long Island, with headquarters at Hicksville, N. Y., was noted in the May issue.

## Purchasing and Stores

**G. D. Tombs** has been appointed division storekeeper on the Illinois Central, with headquarters at Memphis, Tenn., succeeding **A. E. Walters**, who has resigned.

**J. Herbert James**, secretary and chief clerk to the vice-president of the Pittsburgh & Lake Erie, with headquarters at Pittsburgh, Pa., has been promoted to purchasing agent to succeed **C. M. Yohe**, who has been promoted to assistant to the president, with headquarters at Pittsburgh.

**Montgomery Smith** and **William W. Morris**, assistants to the general purchasing agent of the Pennsylvania, with headquarters at Philadelphia, Pa., have been promoted to assistant general purchasing agents, with headquarters in the same city. **George H. Schultz**, coal agent at Pittsburgh, Pa., has been promoted to assistant purchasing agent, with headquarters at the same point, to succeed **W. G. Phelps**, who retired on May 1 under the pension rules.

**George W. Conway**, general storekeeper of the Louisville & Nashville, with headquarters at Louisville, Ky., has retired after 46 years' service with that road. and **Edwin Meyer**, assistant general storekeeper, with headquarters at Louisville, has been promoted to general storekeeper. **E. M. Atkins**, chief clerk, has been promoted to assistant general storekeeper to succeed Mr. Meyer.

## Bridge and Building

**William H. Lytle** has been appointed supervisor of bridges and buildings, with headquarters at Springfield, Ohio, to succeed **Frank McCune**, who has been retired on a pension.

**B. F. Gehr**, formerly master carpenter of the recently abolished Richmond division of the Pennsylvania, with headquarters at Richmond, Ind., has been appointed assistant master carpenter on the Cincinnati division.

**Harry Francis**, bridge and building inspector on the Western division of the Union Pacific, with headquarters at Green River, Wyo., has been promoted to acting supervisor of bridges and buildings on the same division, with headquarters at the same point, to succeed **George Wilson**, who has been granted a leave of absence on account of ill health.

## Obituary

**William J. Sturgess**, formerly roadmaster on the Pocahontas division of the Norfolk & Western, with headquarters at Vivian, W. Va., who retired from active service on November 1, 1919, died on March 25.

**Alfred C. Rupp**, supervisor of track on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Greensburg, Ind., died at his home at Greensburg at the age of 55 years. Mr. Rupp has been in the service of the Big Four for 39 years and had been supervisor for 26 years.

**Frank A. Turner**, assistant engineer on the Texas & Pacific, with headquarters at Dallas, Tex., died on May 10, as a result of injuries received on that date by the breaking of the boom of a derrick engaged in the erection of a bridge across the Atchafalaya river at Melville, La., to replace the structure destroped in the flood of 1927.

**Henry J. Cambie**, who located and constructed portions of the Canadian Pacific in British Columbia more than 50 years ago and later was chief engineer of the Esquimault & Nanaimo at Vancouver, B. C., died in that city on April 23, at the age of 92 years. Mr. Cambie was born in 1836 in Tipperary, Ireland, and came to Canada in 1852, where he entered railway service when he was 16 years old. During the years following 1871 Mr. Cambie made surveys which demonstrated that the Canadian Pacific could be located through the canyons of the Fraser river and also made a location survey for a line between Yellowhead Pass and Port Moody on Burrard Inlet, B. C. He was engineer in charge of construction of that portion of the C. P. R. constructed

by the Canadian government in the Fraser canyon and also of the section between Savona, B. C., and Shuswap. In 1886 Mr. Cambie was appointed division engineer of the Pacific division, with headquarters at Vancouver, and in 1908 was appointed chief engineer of the Esquimault & Nanaimo, with headquarters at Victoria, B. C. Mr. Cambie continued in this position until 1920, when he retired from active business life.

**Howard G. Kelley,** formerly president of the Grand Trunk (now a part of the Canadian National) died suddenly at San Diego, Cal., on April 15, as the result of a cerebral hemorrhage. Mr. Kelley was born on January 12, 1858, at Philadelphia, Pa., and was educated at the Polytechnic College in that city. He entered railway service in 1881 as a flagman on location surveys with the Northern Pacific and subsequently served in various capacities in construction work. He left railway service in 1884 to engage in mining work in Montana until 1887, when he was made resident engineer and superintendent of bridges and buildings on the St. Louis Southwestern, being promoted to chief engineer in 1890. On March 1, 1898, he was appointed chief

**Howard G. Kelley**

engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., and from that time to May of the same year was also consulting engineer of the St. L. S. W. On July 4, 1907, Mr. Kelley was appointed chief engineer of the Grand Trunk system, with headquarters at Montreal, Que., and on October 1, 1911, he was elected vice-president in charge of construction, operation and maintenance. He was elected president of the Grand Trunk and also chairman of the board of the Central Vermont on September 1, 1917, continuing in these positions until August 14, 1922, on which date he resigned, following the taking over of the Grand Trunk by the Canadian Government. After his resignation he returned to the United States where he was actively engaged as an expert in railway matters, in which capacity he made an investigation and report on New England railway problems for the New England Governors' Committee. Mr. Kelley was a charter member of the American Railway Engineering Association and was president of that organization from March, 1906, to March, 1907.

**Paul Didier,** principal assistant engineer of the Baltimore & Ohio system died at his home in Pittsburgh, Pa., on May 19. Mr. Didier was born on June 12, 1850 at Sept-Fontaines, France, and was educated at the Ecole Industrielle, Athenée and Polytechnique. He entered railway service in September, 1872, as an engineer in the projecting department of the Northeast railway at Lille, France, and from March, 1874, to January, 1881, was construction engineer. He came to the United States in 1881 and entered the service of the Baltimore & Ohio as a locating engineer on various lines in western Pennsylvania and West Virginia, in which work he continued until March, 1884, when he was placed in charge of the office of the engineer maintenance of way of the Pittsburgh division. In August, 1886, Mr. Didier was appointed chief engineer of the Pittsburgh & Western and when the control of that road was acquired by the B. & O. in June, 1903, he was appointed district engineer and later was promoted to principal assistant engineer, which position he was holding at the time of his death.

**Robert S. Parsons,** chief engineer of the Erie, with headquarters at New York, died in a hospital at Paterson, N. J., on May 17, after an extended illness. Mr. Parsons was born on May 26, 1873, at Hohokus, N. J., and graduated from Rutgers College. He entered railway service in 1895 as a rodman on the New York division of the Erie and was promoted to assistant engineer in January, 1898. From 1899 to 1907 he was successively assistant engineer and division engineer of roads affiliated with the Erie, and engineer maintenance of way of the Erie, with headquarters at Cleveland, Ohio. From 1907 to January, 1916, Mr. Parsons was in the operating department, serving consecutively as superintendent of the Susquehanna and the New York divisions, assistant general manager of the lines east of Salamanca and Buffalo, with headquarters at New York, and general manager of the Ohio Grand division, with headquarters at Cleveland, Ohio. He was appointed chief engineer in January, 1916, and in 1917 was also assistant to the president. In November, 1917, he was promoted to general manager and continued to act as assistant to the president. From June, 1918, to March, 1920, during the period of federal control, he acted as chief engineer, resuming his duties as general manager when the roads were returned to private operation. Mr. Par-

**Robert S. Parsons**

sons was promoted to vice-president of operation in 1922, and in 1923 was appointed vice-president of the Ohio region. He was appointed chief engineer of the system on February 15, 1927, which position he was holding at the time of his death.

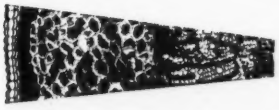
**W. J. Gooding,** division engineer on the Seaboard Air Line, notice of whose death on April 17 was published in the May issue, was born in Hampton County, S. C., on January 17, 1868, and was educated at the University of South Carolina. Mr. Gooding entered the service of the Seaboard Air Line in 1890 as an assistant engineer on the construction of the Southbound Railroad from Columbia S. C. to Savannah, Ga. He continued on construction work until 1907 when he was promoted to division engineer, with headquarters at Jacksonville, Fla. He was transferred to Charleston, S. C., in 1920, at which point he was serving at the time of his death.

---

**The Original Rock Island Bridge at Rock Island, Ill., First Over the Mississippi**

ATLAS NON-POISONOUS WEED KILLER

# *Why* ATLAS N.P. WEED KILLER *is the* Superior Weed Killer *for* Railroads



Shaded areas are Plant Cells showing stored nutrition.

Plant Cells showing exhaustion of nutrition with death by starvation as caused by Atlas N. P.

1. Because after application the weeds and grass are no longer able to absorb nutrition and the roots die.
2. Because it is not poisonous to humans, domestic animals or poultry.
3. Because it is economical to use when applied by the Chipman Automatic Self-regulating Spray Equipment.

Atlas N. P. Weed Killer is prepared only by the Chipman Chemical Engineering Company, Inc. from an exclusive patented formula, founded on sound, scientific experiments with all types of weeds.

By its very nature, Atlas N. P. Weed Killer attacks the "life-blood" of the plant, killing roots and top in one operation. Its action is not confined to the surface, but reaches down deep into the life perpetuating process of the weed.

The explanation of the action of Atlas N. P. Weed Killer and the illustrations, will convince you of its simple effectiveness, its safety, its desirability as *the* weed killer for use on railroads.

## *How Atlas N. P. Kills*

The basic principle of Atlas N.P. Weed Killer is the application of nascent oxygen directly to the weed by means of a carefully prepared and fool-proof method.

The formula is prepared so that it meets with all conditions of climate, ballast or vegetation. It is safe and sure without the possibility of deterioration.

This, briefly, is the basis of the Chipman Chemical Engineering Company's exclusive product—Atlas N.P.—protected by U.S. Patents. Competitors have tried to imitate Atlas N.P., and some are offering products of doubtful effectiveness.

Be sure you get *Atlas N. P. Weed Killer* — it is the only genuine non-poisonous weed killer that really gets results quickly and easily.

**ATLAS**
**-N-P.-**
**WEED KILLER**

Write for further information.

## Chipman Chemical Engineering Co. Inc.

**BOUND BROOK, N. J.**

Chicago, Ill.; Palo Alto, Cal.; Houston, Tex.; Winnipeg, Man.

# Crossing Gates that keep on being seen

WHEN crossing gates are finished in Duco* they gleam with bright, rich colors. Nor do these colors fade to a dull monotone. For Duco colors are lasting—permanent—unfading. Railroad men everywhere are using Duco for switch stand targets, whistling posts, mile posts, destination signs and gas motor cars.

Duco is far superior to old type finishes. It dries incredibly fast. Duco produces a smooth, hard, durable film which lasts through season after season of service. Dirt, dust and cinders cannot imbed themselves in its smooth surface. Extremes of temperature do not affect it. Duco is easily cleaned with soap, water or kerosene, requires no special cleaning compounds, and can be wiped off with a dry rag. Any workman familiar with painting can apply Duco.

Duco, with its rapid drying, keeps refinishing time down to a minimum. And its unusual durability increases the period between refinishing jobs. Duco comes in convenient one-gallon friction top cans. We shall be glad to send additional data on Duco or to have a representative call.

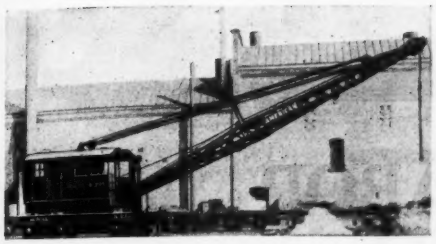
*Special formula for brush application

DU PONT DUCO REG. U.S. PAT. OFF.

**E. I. DU PONT DE NEMOURS & CO., Inc.**
*Railway Sales Department*
PARLIN, N. J.

2100 Elston Ave., Chicago 569 Mission St., San Francisco

DUCO HELPS SELL RAILWAY TRANSPORTATION



# The "AMERICAN" Gasoline Three-Speed Locomotive Crane Couples Steam Crane Flexibility with Gasoline Economy

The convenience and economy of gasoline, with the range and flexibility of steam; until recently a crane that combined these qualities was something to dream about and hope for. Now the dream is realized in the "AMERICAN" Gasoline Three-Speed Crane, which has an automotive gear-shift—three speeds at the finger-tips of the operator, just like on your car—low gear for a powerful start, intermediate for average crane work and traveling and high gear for rapid traveling.

The powerful four-cylinder gasoline motor is set down into the massive deck casting and bolted securely to it. This arrangement virtually eliminates vibration.

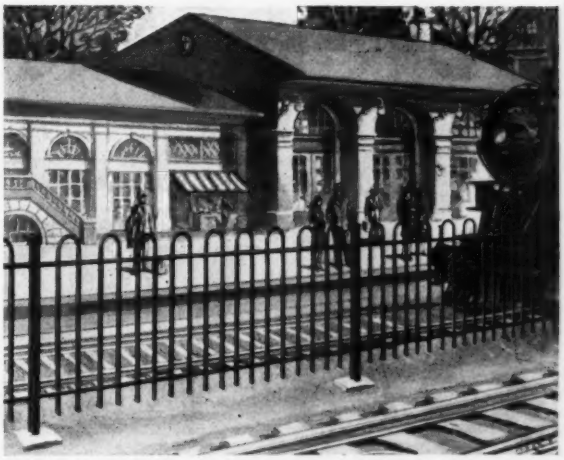
The time-killing fussing with a boiler and fuel is ended; there are no ashes to clean out, no boiler to wash, no flues to develop leaks. It is not necessary to keep a watchman on the machine at night, nor to fire up an hour ahead of time in the morning in order to get up steam. In the morning the crane is all ready to "pop off" and go to work as soon as the operator throws in the switch and steps on the starter. At the end of the day's work all the operator has to do is take the ignition key out of the switch and go home.

Under average conditions, one filling of the 90-gallon fuel tank will run the crane two full 10-hour days—and it is not necessary to stop for water as with steam cranes. The fuel tank is quickly filled from a tender car or a tank wagon, the operation taking less time than one filling of a coal bunker, and of course it will be necessary to fill a coal bunker several times in a two-day run.

*Descriptive booklet now ready.*
*Write for your copy.*

**AMERICAN**
**HOIST & DERRICK CO.**
**Saint Paul, Minn.**
**New York, Chicago, Pittsburgh, St. Louis, New Orleans.**

*The Strength Is in the Weld*



# The *Strongest* Intertrack Railing Made!

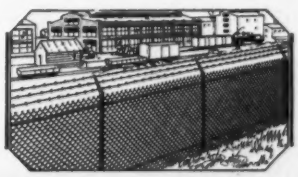
The pickets and rails of this Anchor-Weld Intertrack Railing are electrically fused into solid one-piece panels by the exclusive Anchor Flange-Weld Method.

Each picket is inseparably welded to the rails at 32 points. Pickets cannot loosen. Panels will support not only their own weight but several hundred additional pounds as well.

Standardize on Anchor-Weld Intertrack Railings and maintenance costs will be negligible. Write for detailed information on the seven important features of Anchor-Weld construction.

**ANCHOR POST FENCE CO.**

***Main Office and Factory***
**Eastern Ave. & 35th St., Baltimore, Md.**
***Railroad Division*—9 E. 38th St., New York, N. Y.**
***Branch Offices in Principal Cities***



# ANCHOR *Fences*

NATION-WIDE FENCING SERVICE

INSULATED **GAUGE RODS** NON-INSULATED

# SAVE LABOR TIES DERAILMENTS

FOR STIFF TURNOUTS OR HEAVY CURVES.

AFTER ONE TRIAL, YOUR SECTION MEN WILL SELL YOU FOR REPEAT ORDERS.

***The more severe the test, the better***

**LOUISVILLE FROG & SWITCH CO.**

LOUISVILLE KENTUCKY

# JORDAN SPREADER

THE COMPOSITE SPREADER DITCHER—can be changed in the field either for ditching or for spreading—it performs all the functions of the Spreader (moving earth, spreading bulky material, plowing snow) and in addition will shape the ballast and subgrade, form new ditches and clean out old ones and trim the banks of cuts to a universal slope. An all-year Machine. In use on North America's leading railroads. Write for catalog.

JORDAN SPREADER
"Does the Work of an Army of Men"
SNOW PLOW ICE CUTTER
UNIVERSAL
STANDARD
DITCHER
O.F. JORDAN COMPANY
WALTER J. RILEY, PRESIDENT
EAST CHICAGO, INDIANA

## O. F. JORDAN COMPANY

*WALTER J. RILEY, President* EAST CHICAGO, INDIANA

Depend on DURABLES
MECHANICAL

## *Construction Gang Minutes Can Be Saved*

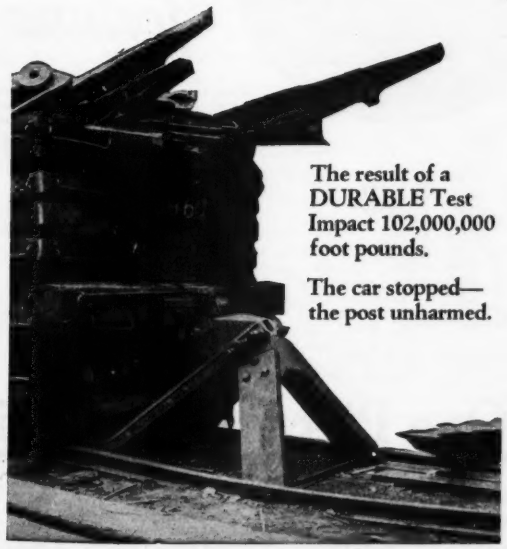
at this time of the year—or any other. One of our most effective sales arguments is that

## The Improved DURABLE *Bumping Post*

without any of its unusual strength being sacrificed, is built to make installation a quick, simple matter—a few minutes and a few men and the post is in place—ready. Installation is easy and quick because there are only a few holes to drill (in the running rails); because all parts are assembled and fitted at the factory before shipping; and because there is not a shovel full of dirt to turn.

And this is the post that is built to stand the heaviest blows—from even the new, heavier rolling stock. Tests by prospective customers have proved its ability.

**The Mechanical Manufacturing Co.**
*Union Stock Yards, Chicago, Illinois*
MECHANICAL



The result of a DURABLE Test Impact 102,000,000 foot pounds.

The car stopped—the post unharmed.

# Protection pays

A definite boundary line of PAGE CHAIN LINK FENCE gives two-way protection. It prevents damage to property—and it prevents personal damage to trespassers.

You can make your property *safe* for yourself—for the public.

**53 Service Plants Erect Fence Everywhere**

There is a distributor near you who can give you the benefit of Page's 45 years of experience. A request brings his name and address, as well as interesting literature.

PAGE FENCE ASSOCIATION
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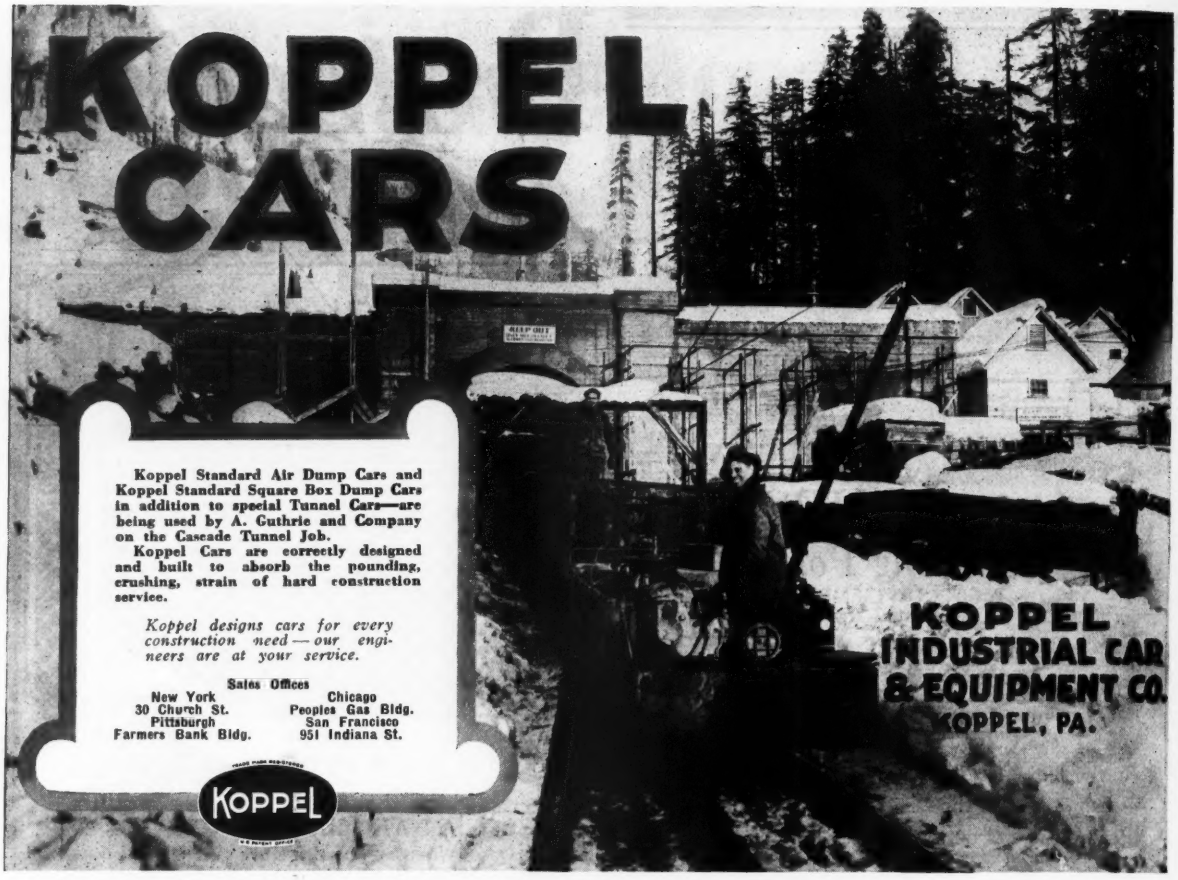
CHICAGO, ILLINOIS

# PAGE
## CHAIN LINK & ORNAMENTAL WROUGHT IRON
# FENCE

53 service plants erect fence everywhere

*America's first wire fence — since 1883*

# KOPPEL CARS




**Koppel Standard Air Dump Cars and Koppel Standard Square Box Dump Cars in addition to special Tunnel Cars—are being used by A. Guthrie and Company on the Cascade Tunnel Job.**

**Koppel Cars are correctly designed and built to absorb the pounding, crushing, strain of hard construction service.**

*Koppel designs cars for every construction need—our engineers are at your service.*

**Sales Offices**

**New York**
**30 Church St.**
**Pittsburgh**
**Farmers Bank Bldg.**
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**951 Indiana St.**

KOPPEL

**Other READING Specialties**

Rail Benders
Compromise Joints
Car and Engine Replacers
Replacer Clamps
Steel and Forged Guard Rail Clamps

ACCO one piece Guard Rails combine into one steel casting the guard rail, clamps, tie-plates, flangeway lugs, footguards and all other parts which ordinarily go to make up a guard rail installation.

## *Consider these 3 important features*

1. Manganese inserts withstand flange wear and can be easily renewed without disturbing the guard rail. ACCO *One Piece* Guard Rails give long service with minimum maintenance expense.
2. This design is distinctive with ACCO. Lugs engage the under side of the rail head, which prevents any possibility of the guard rail tipping.
3. The lugs also engage the base of the traffic rail, assuring proper flangeway and eliminates the necessity of spiking between traffic rail and guard rail.

Let us furnish complete information and prices. Mention rail section and tie spacing in your inquiry.

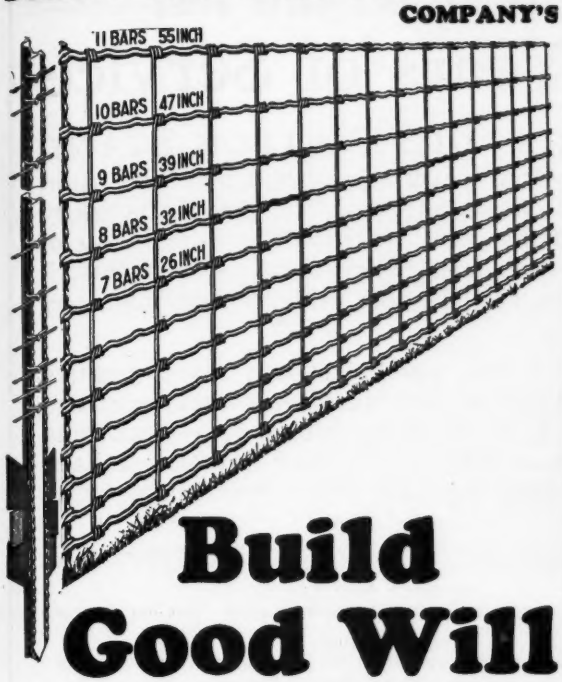
## ACCO One Piece Guard Rail

**AMERICAN CHAIN COMPANY, INC.**
**Bridgeport, Connecticut**

**Brake Beam Chain** | **Brake Beam Safety Chain** | **Door Operating Chain** | **Brake Chain** | **End Door Chain**
**Gate Chain** | **Sling Chain** | **Switch Chain** | **Train Chain** | **Wrecking Chain** | **Crane Chain**

***World's Largest Manufacturers of Welded and Weldless Chain for every Railroad Purpose***

# American Steel & Wire COMPANY'S




# Build Good Will Along Your Right of Way With Good Fence

Right of way fences erected properly with steel posts keep out livestock and trespassers and keep the farmers and the public along your road satisfied that every precaution is being taken to prevent accidents. This also means reducing losses through liability and property damage.

American Railroad Fence and Banner Steel Posts meet every specification recommended by the American Railway Engineering Association.

Using Banner Steel Posts not only insures better looking fence but saving labor in fence building. A test made by a leading railroad proved that one man could drive five Banner Posts in the same time required for setting one wooden post.

**American Steel & Wire Co.**

*DEALERS EVERYWHERE*

*Sales Offices: Chicago, New York, Boston, Atlanta, Birmingham, Cleveland, Worcester, Philadelphia, Pittsburgh, Buffalo, Detroit, Cincinnati, Baltimore, Wilkes-Barre, St. Louis, Kansas City, Minneapolis-St. Paul, Oklahoma City, Memphis, Dallas, Denver, Salt Lake City, *San Francisco, *Los Angeles, *Portland, *Seattle*

**United States Steel Products Co.*

# PAINT

## that fought cinders and gases for 12 years

Typical of the conditions a metal protective paint must meet are those under which Dixon's Silica-Graphite Paint has served the W-B. & H. Ry. on the bridge shown above. Yet one painting with Dixon's Paint lasted 12 years and provided ample protection during the entire time.

We have other authentic records showing up to 20 years service for Dixon's Paint on iron and steel surfaces under a wide variety of adverse atmospheric and operating conditions.

The reason for such unusual paint service lies in the special form of graphite used—crystalline flake in natural combination (not artificial mixture) with silica. The vehicle is boiled linseed oil.

True, Dixon's costs more, but it delivers more years of service and decreased paint maintenance costs. It is a paint that really protects from atmospheric and corrosive conditions and will outlast cheaper grades many times.

*Write for Color Card and Booklet No. 187B.*

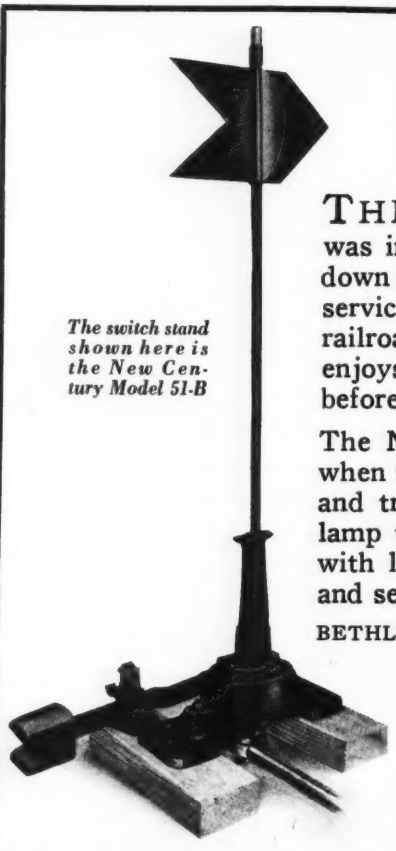
**JOSEPH DIXON CRUCIBLE CO.**

Jersey City New Jersey

*Established 1827*

# DIXON'S Silica Graphite PAINT

ADEQUATE PROTECTION AT MINIMUM ULTIMATE COST



*The switch stand shown here is the New Century Model 51-B*

## *It has stood the test* of 34 Years of Service

THE NEW CENTURY SWITCH STAND was introduced thirty-four years ago. From that time right down to the present it has been giving the most satisfactory service, and as a result has won the respect and confidence of railroad men. Now, with many important improvements, it enjoys greater respect and is more widely used than ever before.

The New Century is a low, parallel switch stand, positive when thrown by hand and latched; automatic when unlatched and trailed through. It is made in three styles—with plug lamp tip for use with switch lamp having day target discs, with low target and lamp tip, and with intermediate target and seven-foot mast.

BETHLEHEM STEEL COMPANY, *General Offices: BETHLEHEM, PA.*

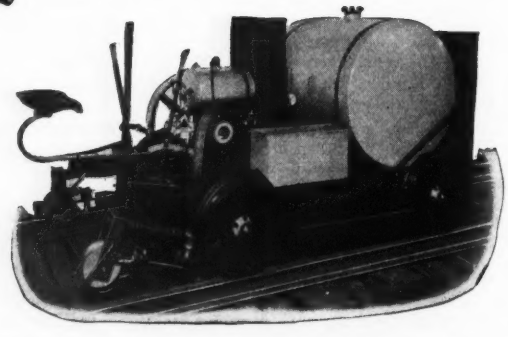
DISTRICT OFFICES:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Cleveland Detroit Cincinnati Chicago St. Louis San Francisco Los Angeles Seattle Portland

*Bethlehem Steel Export Corporation, 25 Broadway, New York City*

Sole Exporter of Our Commercial Products

# BETHLEHEM



## Oils Rail-Joints or the Continuous Rail

The unit machine shown above has ample capacity for oiling rail-joints, even on long sections.

When continuous rail oiling is desired, extra capacity is provided by a trailer tank-car similar to the car used for the Woolery Weed Burner.

Write us your requirements and we will send you full details as to capacity. Plan now to oil your rail-joints this season.

## NOW Rail-Joint Oiling Is an Even Greater Economy

Corroding of rails and rail-joints is now preventable at so much lower cost than ever before, that it is extravagance not to protect your track joints.

**Woolery RAIL JOINT Oiler**

Built on a sturdy, heavy-duty steel frame car and powered with the Woolery Ball-Bearing Engine, the WOOLERY RAIL-JOINT OILER is a single unit, one-man drive machine that oils rail-joints better than hand labor at a fraction of the cost. Reports show a cost of less than $1.00 per mile—instead of the $5.00 to $9.00 cost per mile reported for hand oiling.

Uses any kind of oil, paint or grease—oils joints or the continuous rail at 10 miles per hour. Is simple in operation.

When ordered, a Woolery Weed Burner may be equipped with the Woolery Rail-Joint Oiler.

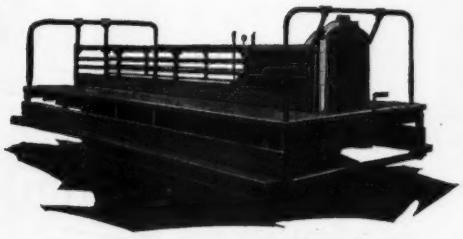
Priced low—quickly pays for itself.

*To insure delivery, orders must be placed early—write for details.*

**Woolery Machine Co.**

2913 Como Ave. S. E. Minneapolis, Minn.

BUDA
ESTABLISHED 1881



Hump Car—Capacity 50 Men—Engine Supplied for any R.R. Grade

# BUDA No. 619
## HEAVY DUTY
# Motor Car

**4 Wheel Brakes—Alemite Lubrication**
**Two or Four Wheel Final Drive**

A real **Heavy Duty Motor Car**—The Buda No. 619. Can be equipped with Buda 4 or 6 cylinder engines—ranging from 37 to 114 Brake Horse Power—grades up to 10%. Buda Motor Cars meet every requirement—from 1 to 2-man cars up to 12-ton capacity—which can be provided with MCB couplers for handling standard railroad cars—with body for light freight or passenger service.

**No. 519** A TWO-WAY DRIVE Center Load One-Man Car—Steel Frame Construction—Safe—Light—Economical—Comfortable

*Write for Catalogs*

# THE BUDA COMPANY
## HARVEY (Chicago Suburb) ILLINOIS

| 30 Church Street | Hurt Bldg. | Railway Exchange | Railway Exchange | 664 Mission Street | Cecil Chambers, Strand |
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| NEW YORK | ATLANTA, GA. | CHICAGO | ST. LOUIS | SAN FRANCISCO | LONDON, W. C. 2 |

## *"WOLF" Saw saves 100% in time and labor for C. & N. W. at Council Bluffs, Ia.*

This is the report of F. C. Huffman, Asst. Chief Engineer of the Chicago & North Western Railway. The job at Council Bluffs was cutting piling 12-14" dia. in positions where a hand cross cut saw could have been used only with the greatest difficulty as is apparent from the cut at the right.

The latest development in increasing the field of usefulness of the "Wolf" saw is the application of the type "A" Ingersoll-Rand air motor as shown below. This is already in successful operation by some of the largest railroads and contractors (names on request).

Railroad users include:
N. Y. N. H. & H. R. R.
Southern Pacific R. R.
A. T. & S. F. R. R.
C. B. & Q. R. R.
Ft. W. D. & S. P. R. R. Co.
Alaska R. R.
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## REED-PRENTICE CORPORATION
**Worcester, Mass.**

New York Office: 1508 Evening Post Bldg., 75 West Street
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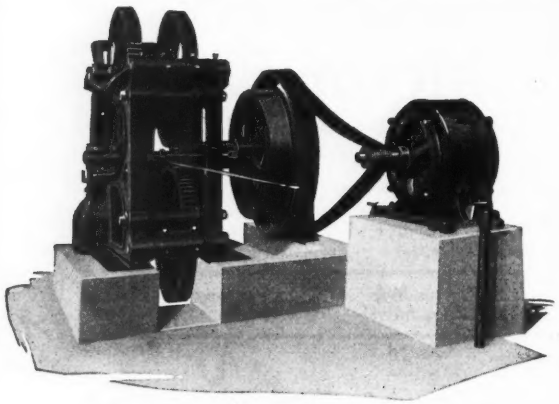
# "POMONA"

## DOUBLE STROKE DEEP WELL POWER PUMPS



## USED ON MANY OF THE LARGEST RAILROADS

Pomona Double Stroke Deep Well Power Pumps are supplying water to a number of large railroads throughout the country. Railways prefer them because they do their work dependably, efficiently and economically.

## IDEAL PUMPING EQUIPMENT

Pomona Pumps are correctly and simply designed. The reciprocating double stroke delivers a steady flow of water from minimum power consumption. And they are so ruggedly built of quality materials that maintenance costs are practically nil. Pomona Engineers will gladly show you the way to better pumping without obligation. Write for Pomona Catalog.

**UNITED IRON WORKS, Inc.**
**SPRINGFIELD, MO.**

*(General Offices—KANSAS CITY, MO.)*

"UNITED" IRON WORKS INC. WELDED FOR SERVICE

PREMAX METAL MARKERS

For Every Numbering Requirement

Premax aluminum letters, figures and pole tags eliminate the difficulty of painting or stenciling creosoted poles and timbers.

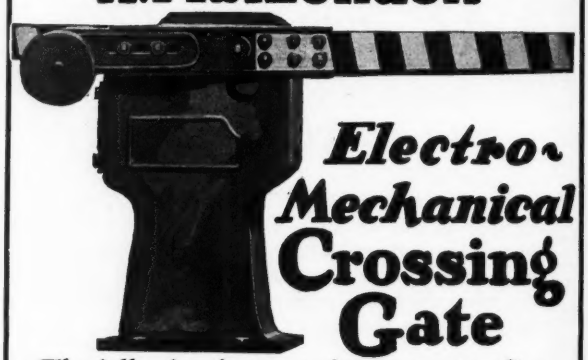
Permanent, economical and easily applied to either steel or wood, these clear cut, legible characters stand out clearly and without the need of painting a separate ground.

*Railroad Supply Agents*

The Railroad Supply Co.
*New York, Chicago and principal cities.*

NIAGARA METAL STAMPING CORP.
*Niagara Falls, N. Y.*
Dept REM 6-28

**A. Plamondon**



## *Electro-Mechanical* Crossing Gate

*The following features give an outstanding advantage to this gate*

*Operates* Electro-Mechanically. A push button or remote automatic electric control will operate any number of units.

*Speed*—Starts, accelerates smoothly, and comes to an instant stop in four to four and one-half seconds.

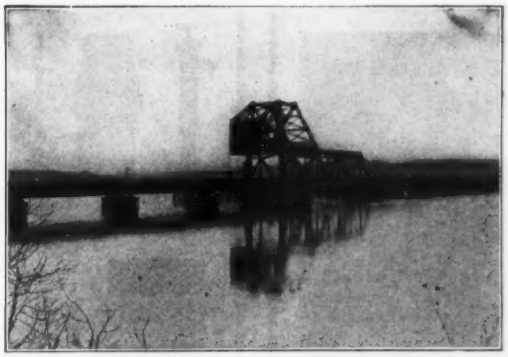
Splendid workmanship and materials used thru out.

*Write for complete description.*

**A. PLAMONDON—Division of**

**FOOTE BROS. GEAR & MACHINE CO.**
**225 N. Curtis St., CHICAGO, Ill.**

# Coated 3 Years Ago—



# —Still Perfect Today

NO-OX-ID "A Special" stops rust from the brine drippings of refrigerator cars on the deck of this bridge over the Illinois River, and from the many natural corrosive influences always present. It will do the same for your structural steel everywhere, reducing your maintenance cost considerably. The original coat of NO-OX-ID, which was applied three years ago to the deck of this bridge, is still functioning.

*Write us your corrosion problems and let us prescribe the remedy.*

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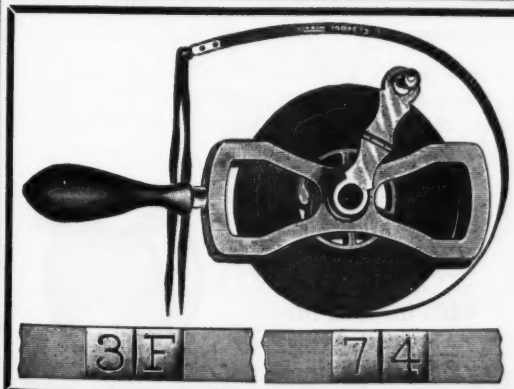


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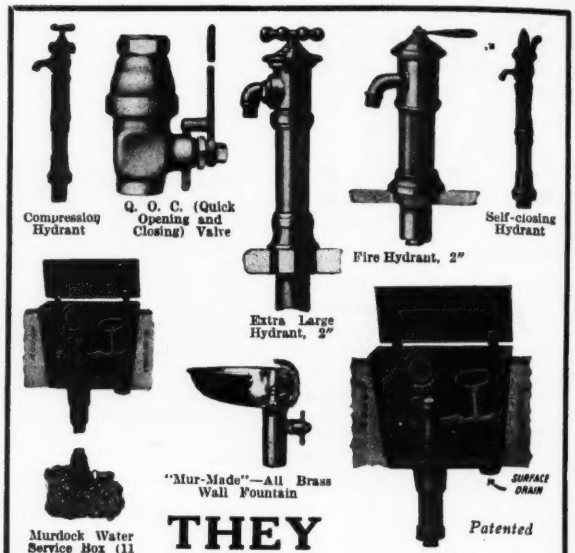


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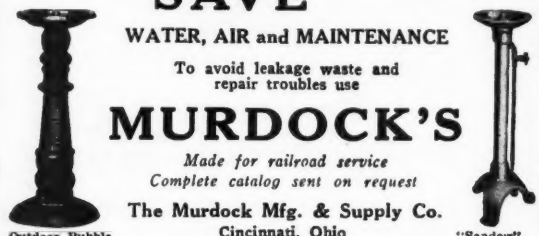
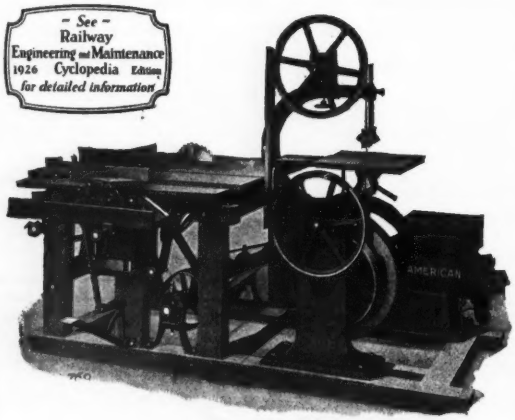



# COST CUTTERS

– See – Railway Engineering and Maintenance 1926 Cyclopedia Edition for detailed information



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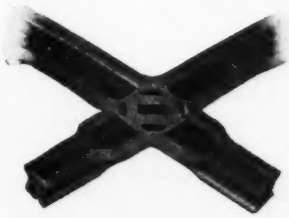

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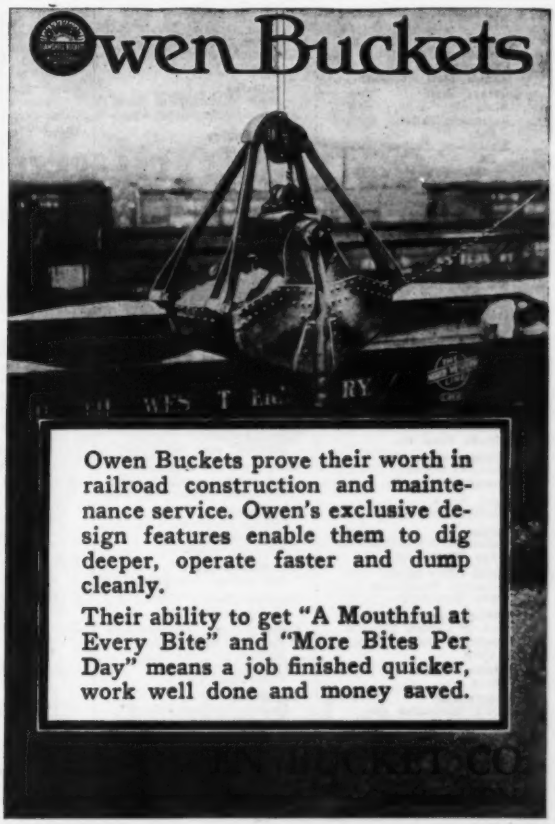

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See Rail Anchors

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**Bearings, Tapered Roller; Thrust and Journal Box**
Timken Roller Bearing Co.

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**Cars, Dump**
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Northwestern Motor Co.
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Portland Cement Assn.

**Cement Roofing Tile**
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Barber Asphalt Co.
Carey Co., Philip

**Chemical Weed Killer**
Chipman Chemical Engineering Co., Inc.

**Clamshell Buckets**
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**Compressors**
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**Compromise Joints**
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Prendergast Co.

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Foote Bros. Gear & Machine Co.
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Prendergast Co.

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National Rock Asphalt Corp., Inc.
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Prendergast Co.

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Ingersoll-Rand Co.
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Ingersoll-Rand Co.
Sullivan Machinery Co.

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Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.

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See Cranes

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Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

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Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

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Page Fence Association

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Buda Co.
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Ramapo Ajax Corp.
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**Gas, Acetylene**
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Buda Co.
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Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

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Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

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Ingersoll-Rand Co.

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Ingersoll-Rand Co.
Sullivan Machinery Co.

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Sullivan Machinery Co.

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Ingersoll-Rand Co.
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Timken Roller Bearing Co.

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Ingersoll-Rand Co.

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Chicago Pneumatic Tool Co.
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Murdock Mfg. & Sup. Co.

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Jordan Co., O. F.

**Insection Cars**
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**Inspection, Engineering**
Hunt Co., Robert W.

**Insulated Rail Joints**
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Q. & C. Co.
Rail Joint Co.

**Insulating Material**
Lehon Co.

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Buda Co.
Kalamazoo Railway Supply Co.

**Jacks, Track**
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

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Q. & C. Co.
Rail Joint Co.

**Joint Fastenings**
Illinois Steel Co.

**Joints, Rail**
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Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

**Joints, Step**
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Q. & C. Co.
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It attains a fifty degree angle when in full dump position assuring a complete discharge of any load clear of the ballast. This car is not only suitable for dump car service and general maintenance work but also for regular revenue service. It is a multi-purpose car.

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OUR FIELD MEN WILL BE GLAD TO ASSIST YOU WITH ANY INSTALLATIONS OF BITUROC

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Dixon Crucible Co., Jos.

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Southern Cypress Mfrs. Ass'n.

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Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Manholes**
Massey Concrete Products Corp.

**Markers**
Massey Concrete Products Corp.
Niagara Metal Stamping Corp.

**Mile Posts**
Massey Concrete Products Corp.

**Motor Bearings**
Timken Roller Bearing Co.

**Motor Cars**
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**Mowing Machines**
Fairmont Railway Motors, Inc.

**Number Plates**
Niagara Metal Stamping Corp.

**Non-Derailer**
Ramapo Ajax Corp.

**Nut Locks**
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Nuts**
Bethlehem Steel Co.
Illinois Steel Co.

**Oil Engines**
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**Out Houses**
Massey Concrete Products Corp.

**Oxygen**
Oxweld Railroad Service Co.

**Oxy-Acetylene Welding Equipment**
Oxweld Railroad Service Co.

**Paint**
Dixon Crucible Co., Jos.
DuPont de Nemours & Co. Inc., E. I.

**Paint, Metal Protecting**
Dixon Crucible Co., Jos.

**Pavement Breakers**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Pile Drivers**
American Hoist & Derrick Co.
Ingersoll-Rand Co.
Industrial Brownhoist Corp.

**Piling**
Carnegie Steel Co.
Jennison-Wright Co.
Massey Concrete Products Corp.

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American Casting Co.
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

**Pipe Carriers**
Massey Concrete Products Corp.

**Pipe, Concrete**
Massey Concrete Products Corp.

**Pipe, Corrugated**
Armco Culvert Mfrs. Assn.

**Pipe Joint Compound**
Dixon Crucible Co., Jos.

**Pipe, Sewer**
American Casting Co.
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.

**Plates, Miscellaneous**
Ramapo Ajax Corp.
Track Specialties Co.

**Platforms, Station**
Kentucky Rock Asphalt Co.
Natural Rock Asphalt Corp., Inc.
Ohio Valley Rock Asphalt Co.

**Poles**
Jennison-Wright Co.
Massey Concrete Products Corp.

**Posts, Concrete, Fence, Mile, Etc.**
Prendergast Co.

**Posts, Fence**
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**Posts, Bumping**
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**Post Hole Diggers**
Buda Co.

**Powders**
DuPont de Nemours & Co. Inc., E. I.

**Power Plants, Portable**
Electric Tamper & Equipment Co.
Northwestern Motor Co.
Syntron Co.

**Preformed Track Pavement**
Carey Co., Philip

**Preservation, Timber**
Jennison-Wright Co.

**Products, Gas**
Oxweld Railroad Service Co.

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Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
United Iron Works, Inc.

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Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.

**Push Car Bearings**
Timken Roller Bearing Co.

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Bethlehem Steel Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Rail Anti-Creepers**
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**Rail Benders**
American Chain Co., Inc.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
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**Rail Bonds**
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Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

**Rail Expanders**
Ramapo Ajax Corp.

**Rail Joints**
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**Rail Layers**
Nordberg Mfg. Co.

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Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

**Rail Springs**
Verona Tool Works

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Bethlehem Steel Co.

**Rails, Tee**
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Carnegie Steel Co.

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Oxweld Railroad Service Co.

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American Chain Co., Inc.
Buda Co.
Q. & C. Co.

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Federal Cement Tile Co.
Massey Concrete Product Corp.

**Rivets**
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**Rock Hammers**
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Oxweld Railroad Service Co.

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Federal Cement Tile Co.
Massey Concrete Products Corp.

**Roofing, Cement & Concrete Tile**
Federal Cement Tile Co.

**Roofing Composition**
Lehon Co.

**Rules**
Lufkin Rule Co.

**Rust Preventive**
Dearborn Chemical Co.

**Safety Flags**
Louisville Frog & Switch Co.

**Saw Mills**
American Saw Mill Machy. Co.

**Saw Rigs**
American Saw Mill Machy. Co.

**Saws, High Speed Friction**
American Saw Mill Machy. Co.

**Saws, Electric**
Reed-Prentice Corp.

**Saws, Pneumatic**
Reed-Prentice Corp.

**Scales, Tape**
Lufkin Rule Co.

**Scoops**
Ames Shovel & Tool Co.

**Screw Spikes**
Illinois Steel Company

**Screw Spike Drivers**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Section Cars**
See Cars, Section

**Sharpeners, Rock Drill Steel**
Ingersoll-Rand Co.

**Sheathing Paper**
Lehon Co.

**Sheet Iron**
Armco Culvert Mfrs. Assn.

**Shingles, Composition**
Lehon Co.

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Verona Tool Works
Woodings Forge & Tool Co.

**Shovels, Steam**
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Northwest Engineering Co.

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Massey Concrete Products Corp.

**Skid Excavators & Dredges**
Northwest Engineering Co.

**Skid Shoes**
Q. & C. Co.

**Slabs, Concrete**
Massey Concrete Products Corp.

**Smoke Stacks**
Massey Concrete Products Corp.

**Snow Melting Device**
Lundie Engineering Corp.
Q. & C. Co.

**Snow Plows**
Jordan Co., O. F.
Q. & C. Co.

**Spades**
Ames Shovel & Tool Co.

**Spike Pullers**
Louisville Frog & Switch Co., Inc.

**Spikes**
Bethlehem Steel Co.
Illinois Steel Company

**Spreader Cars**
See Cars, Spreader

**Spreaders, Ballast**
See Ballast Spreaders

**Stands, Switch & Target**
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.

**Steel, Alloy**
Central Alloy Steel Corp.
Illinois Steel Company

**Steel Cross Ties**
Carnegie Steel Co.

**Steel, Electric Furnace**
Timken Roller Bearing Co.

**Steel, Open Hearth**
Timken Roller Bearing Co.

**Steel Plates and Shapes**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

**Steel, Special Analysis**
Timken Roller Bearing Co.

**Step Joints**
See Joints, Step.

**Structural Steel**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

**Switch Guard**
Ramapo Ajax Corp.

**Switches**
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Switchmen's Houses**
Massey Concrete Products Corp.

**Switchstands & Fixtures**
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Tampers, Tie**
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**Tapes, Measuring**
Lufkin Rule Co.

**Tee Rails**
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**Telegraph Poles**
See Poles

**Telegraph Service, Long Distance**
American Telephone & Telegraph Co.

**Telephone Service, Long Distance**
American Telephone & Telegraph Co.

**Testing of Materials**
Hunt Co., Robert W.

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**Ties**
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**Tie Plate Clamps**
Q. & C. Co.

**Tie Plates**
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

**Tie Rods**
Bethlehem Steel Co.

**Tie Scorer**
Woolery Machine Co.

**Tie Tampers**
Chicago Pneumatic Tool Co.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

**Tile, Roofing**
Federal Cement Tile Co.

**Timber**
Southern Cypress Mfrs. Ass'n.

**Timber, Creosoted**
Jennison-Wright Co.

**Tools, Drainage**
Ames Shovel & Tool Co.

**Tools, Oxy-Acetylene Cutting & Welding**
Oxweld Railroad Service Co.

**Tools, Pneumatic**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Tools, Track**
Ames Shovel & Tool Co.
Buda Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Tongue Switches**
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

**Torches, Oxy-Acetylene Cutting & Welding**
Oxweld Railroad Service Co.

**Track Braces**
See Braces, Track

**Track Crane**
Nordberg Mfg. Co.

**Track Drills**
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**Track Gages**
Buda Co.
Kalamazoo Railway Supply Co.

**Track Insulation**
Q. & C. Co.

**Track Jacks**
See Jacks, Track

**Track Levels**
Kalamazoo Railway Supply Co.

**Track Liners**
See Liners, Track

**Track, Special Work**
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

**Track Tools**
See Tools, Track

**Trestle Slabs**
Massey Concrete Products Corp.

**Trucks, Hand, Steel**
Anchor Post Fence Co.

**Tubing, Seamless Steel**
Timken Roller Bearing Co.

**Ventilators**
Q. & C. Co.

**Water Treating Plants**
Dearborn Chemical Co.

**Waterproofing Fabrics**
Lehon Co.

**Weed Burner**
Fairmont Railway Motors, Inc.
Woolery Machine Co.

**Weed Killer**
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

**Welding & Cutting Equipment**
Electric Railweld Service Corp.
Oxweld Railroad Service Co.

**Welding, Electric**
Electric Railweld Service Corp.

**Welding, Oxy-Acetylene**
Oxweld Railroad Service Co.

**Wheels, Hand & Motor Car**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Northwestern Motor Co.
Woolery Machine Co.

**Wheels, Wrought Steel**
Carnegie Steel Co.

**Wire Fencing**
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
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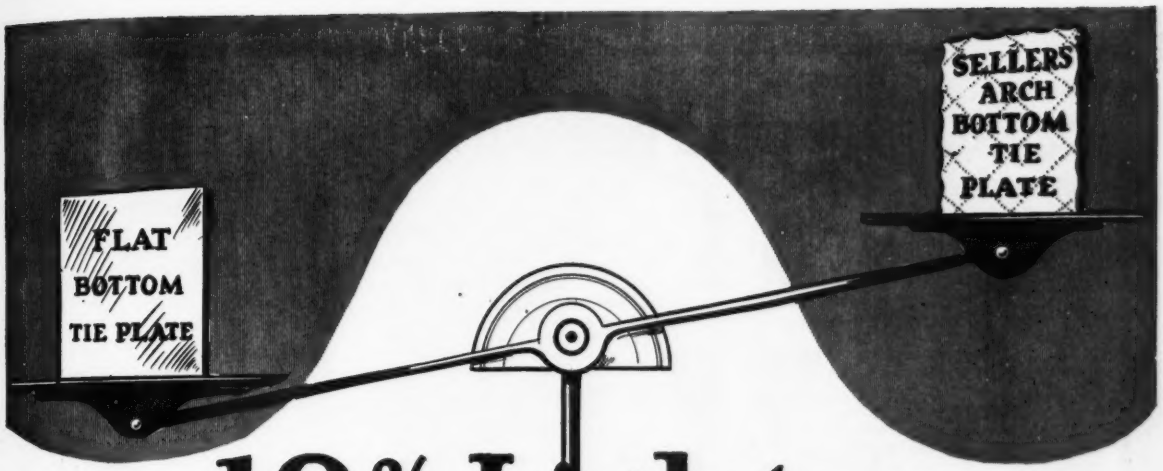
**Wood Preservation**
See Preservation, Timber

**Wood Working Machinery**
American Saw Mill Machy. Co.

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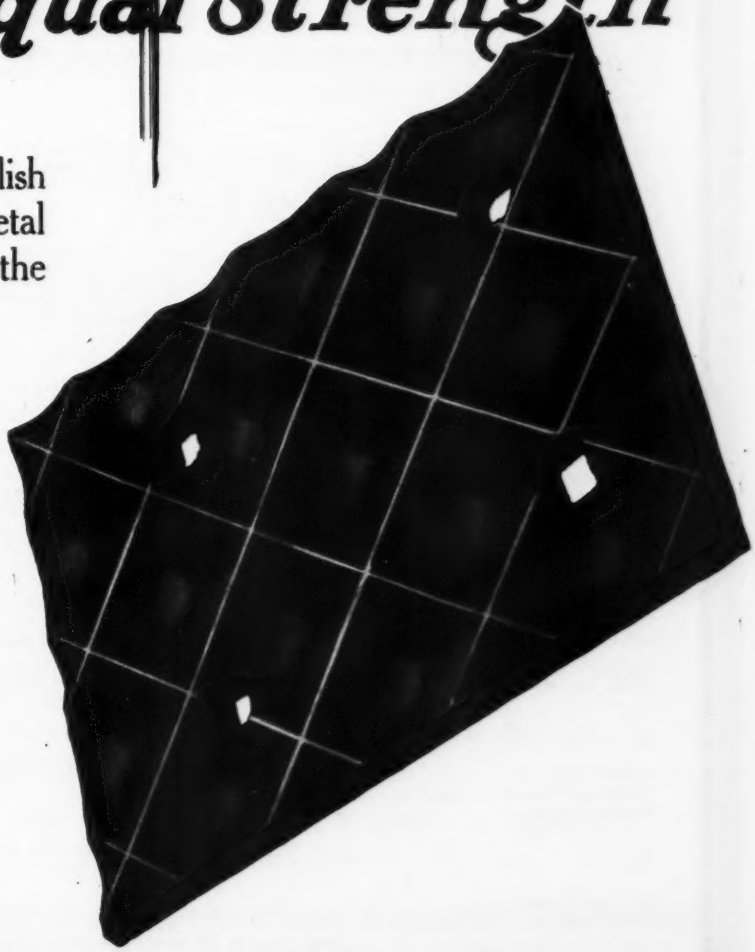

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ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS

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# LEADERSHIP

OVER twenty years ago we advocated to the railroads of this country the adoption of a drastic new theory pertaining to the proper functioning of spring washers, then termed nut locks. The immediate response was none too encouraging.

Six years ago we brought out IMPROVED HIPOWER—a device incorporating the principles necessary to the successful application of our theory.

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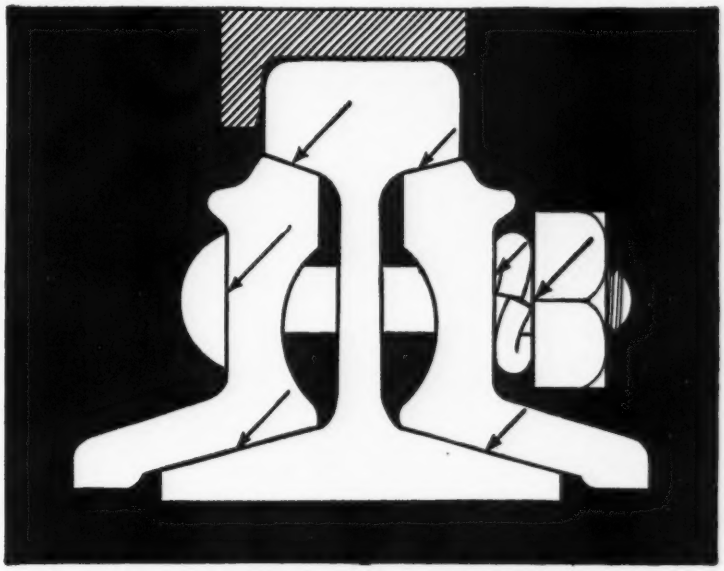
In over twenty years our fundamental principles of spring washer efficiency have never varied. The adoption of IMPROVED HIPOWER by the bulk of America's railroads has revolutionized the entire industry.



*The arrows indicate the contact surfaces at which IMPROVED HIPOWERS retard wear.*

*There are many points of IMPROVED HIPOWER superiority. This is point of superiority No. 4.*

## COSTS 90% LESS PER 1000 LBS. PRESSURE

A SPRING washer is bought for its *spring* value or reactive pressure. Its cost, therefore, can be properly figured only upon the basis of the price per pounds of pressure.

A spring washer must be able to function as a spring under great pressure if it is to snub the smashing blows that would otherwise batter rail ends and mutilate joint bars. IMPROVED HIPOWER by virtue of patented superimposed curves is commercially non-flattenable. Its spring power is unimpaired under all loads of traffic.

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**Commercially Non-flattenable - - Permanently Rust-Proof**

# Speed Up Your Steel Gangs!!

## Use VERONA Ratchet Action Wrench

## With this wrench 5 men will do the work of 6

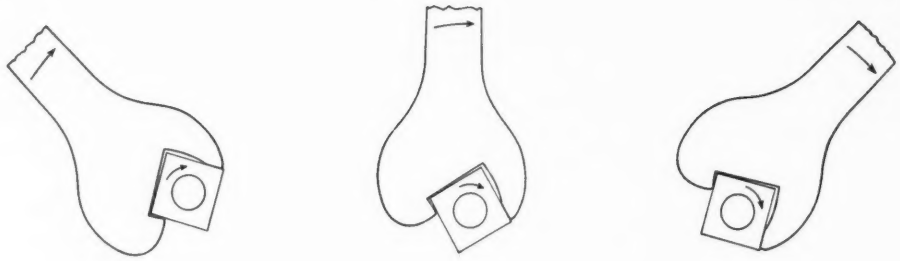

Fig. 1 Fig. 2 Fig. 3

*Showing one-quarter turn of nut with wrench*

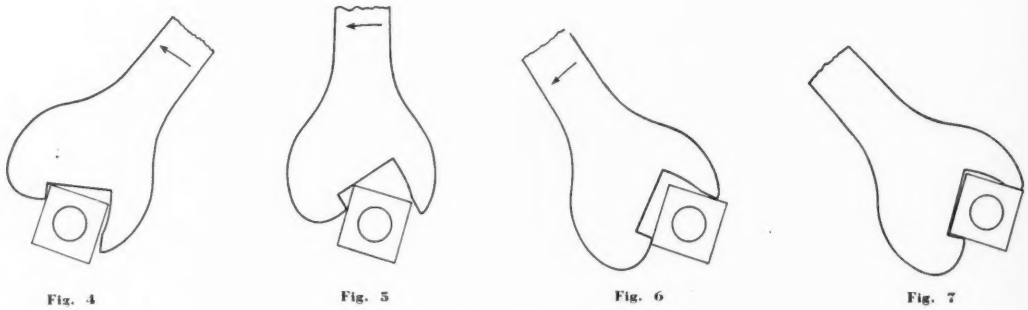

Fig. 4 Fig. 5 Fig. 6 Fig. 7

*Showing ratchet action of wrench*

***Buy now to use on your next relaying job***

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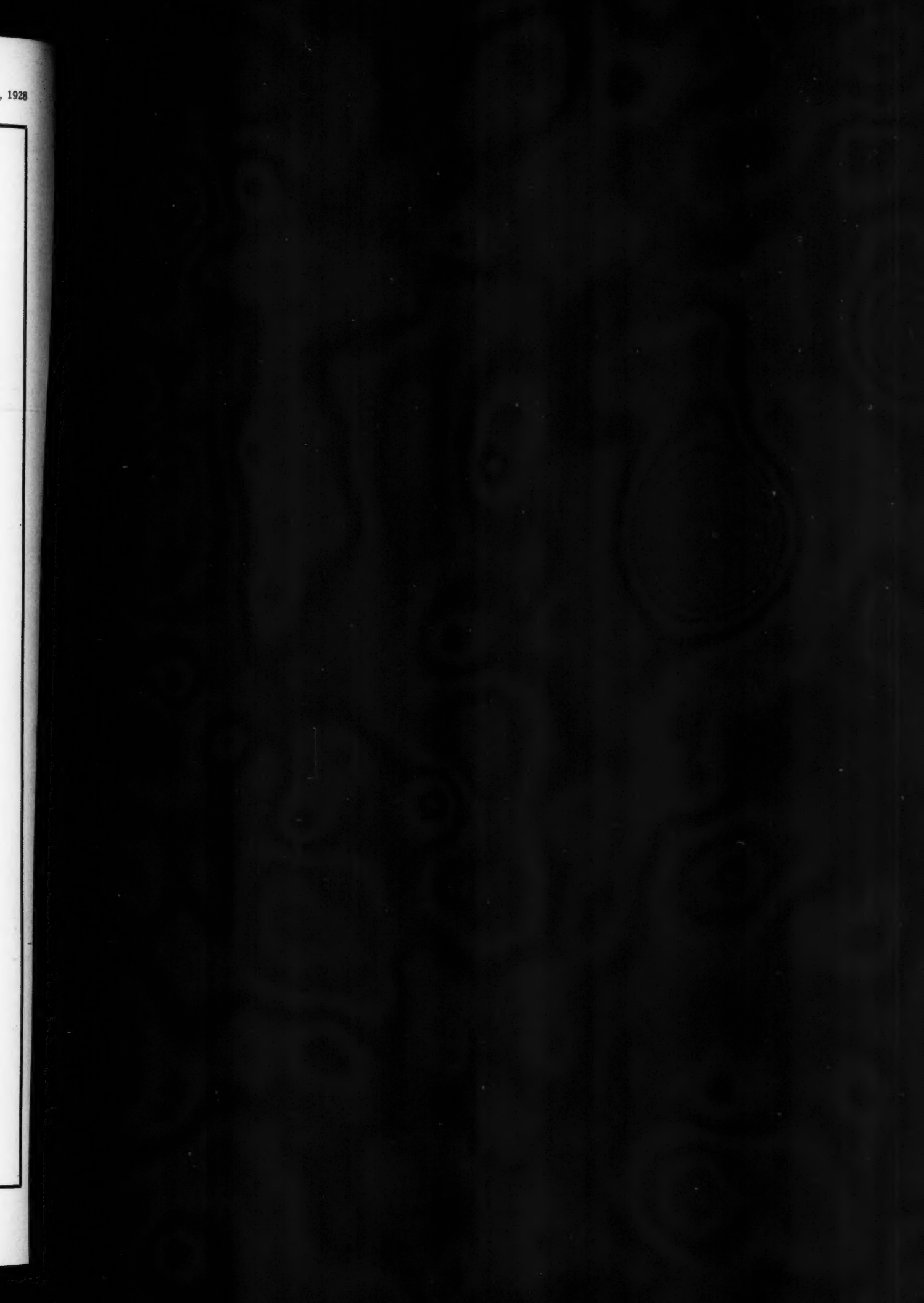
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